Technical Specifications

smart hot runner solutions

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Recommended Design Guidelines for Tooling

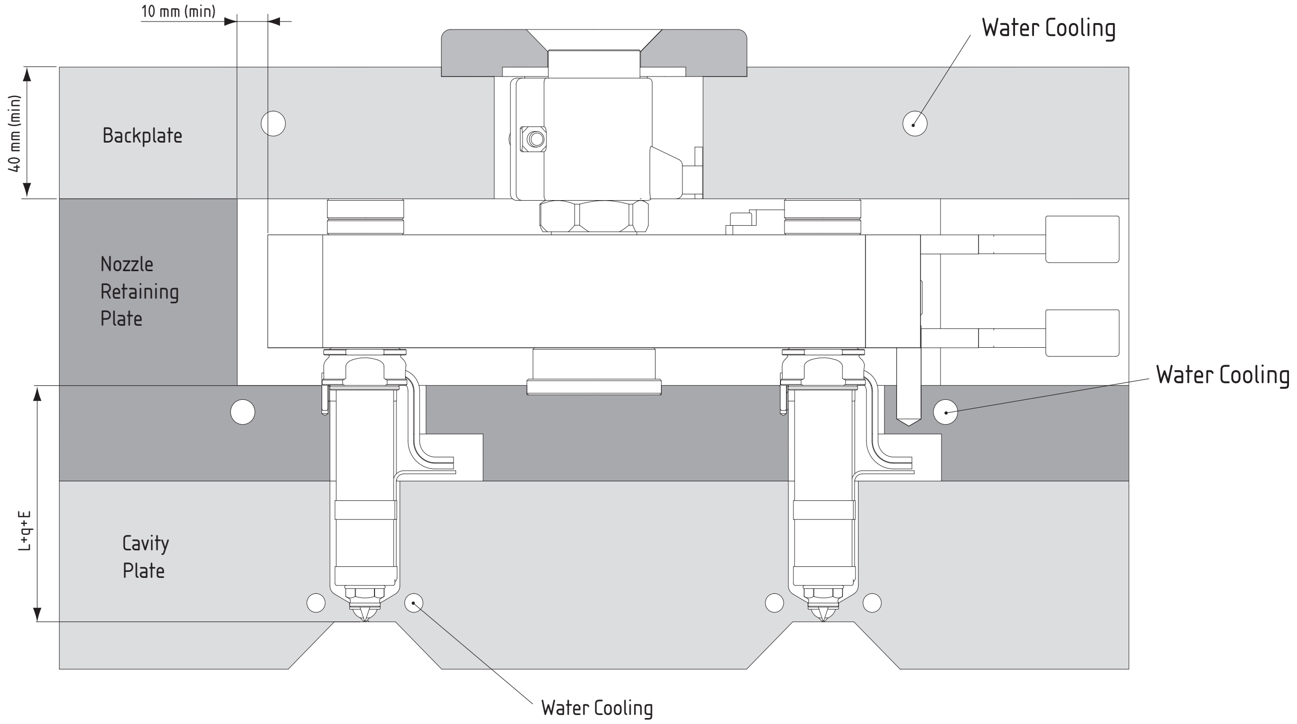

Figure 1: Example Layout for a High Production Manifold

- Use tool steels for nozzle retainer plate and back plates to increase rigidity and reduce hobbing (recommended minimum of P20, 30HRC, 800MPa Yield Strength).
- Use a thick nozzle cavity plate with longer nozzles for better rigidity and longevity. Make provisions for extra water cooling in middle of plate around nozzles.
- Machine the manifold cavity from one piece of solid steel and add provision for water cooling.
- Use thick back plates (minimum 40 mm thick for small to medium size moulds).
- Provide adequate manifold clamping between the back plate and the nozzle cavity plates to ensure sealing between manifold and nozzles. Mastip recommends three bolts per drop with a minimum of two bolts per drop as close to manifold as possible. (See Back Plate Clamping around a Manifold section.)
- Maintain accuracy for the nozzle head seating faces and the nozzle nut sealing area. The manifold must have the correct L, q and E values for the nozzles used. (See the Nozzle Expansion Calculation section to calculate E).
- Allow for manifold and nozzle expansion.
- Ensure there is adequate cooling around the gate area. (See the Gate and Nozzle Cooling Styles section for more information).
- Where possible, use an extra split line to allow for servicing of the nozzle and the gate without having to strip down the hot half.
- Make sure wiring is not exposed to the direct heat of the manifold. Use aluminium shields over the wiring troughs, if needed.
- Provide suitable wiring channels for the nozzles, thermocouples, and manifold heaters. Wiring should be directed to a terminal box (typically located on the top of the mould on the non-operator side). Do not crush or excessively bend wires. Secure wires with clips or a cover. (See Wiring section for more information.)
- Allow for 10 mm minimum air gap (the manifold cavity) between the manifold and the mould to ensure adequate thermal insulation between the two.

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- Ensure wire channels do not cross the manifold spacers.

Additional Design Considerations for a Valve Gate System

In a valve gate system, you must also machine slots for feed lines.

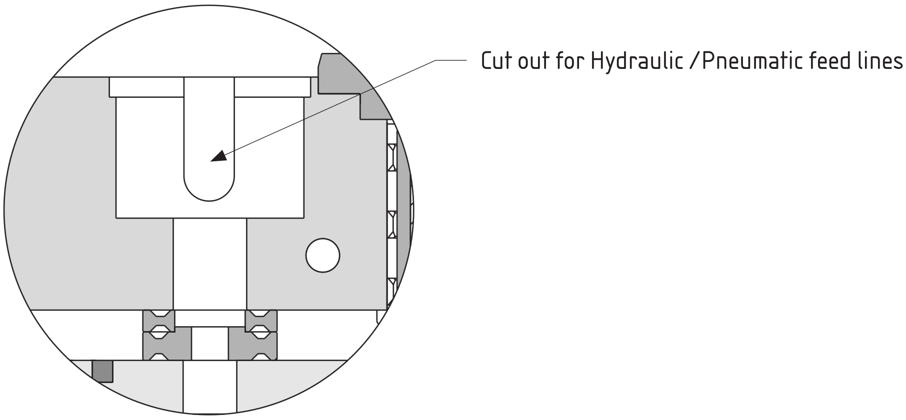

Figure 2: Slots for Feed Lines

If necessary, machine the slot for feed lines right through the back plate to allow for ease of fitting from the back of the tool.

Design Considerations for a Mould with a Single Nozzle Application

The following items must be considered when designing a mould for use in a single nozzle application:

- With a standard nozzle, ensure there is minimum contact with the locating ring to prevent excess heat loss.
- Provide adequate allowance for wires.
- Ensure dowel is positioned opposite the wire slot.

Gate Modifications

Occasionally, it is desirable to enlarge the recommended gate diameter ('G') in the mould to increase the flow of plastic melt for a given nozzle size. It should be noted that flow increases exponentially with the increase in gate diameter, therefore, adjust gate size in small increments.

Caution: When modifying the gate area, you must not enlarge the gate land ('q') beyond 0.2 mm.

Valve Gate Details

Valve gate profiles incorporate a 40° taper in the front of the gate to seal and align the pin.

The end user must machine this taper on the supplied pins to suit the mould height.

The gate profile in tool should be made from a hardened steel to allow for the action of the pin on gate taper.

Note: Mastip Thermal Gate and Valve Gate profiles are not interchangeable (that is, you cannot machine a 40° taper into an existing nozzle gate and use a valve gate system).

Gate Diameter

Note: Mastip does not recommend increasing the gate diameter ('G') more that 50% above the size shown in the Mastip Nozzle catalogue. If a larger gate is required, a larger nozzle should be considered.

You must adjust the nozzle gate diameter to suit the part you are moulding. Mastip includes a generic gate diameter in the Nozzle Fitment and Gate Dimension section for each type of nozzle. To determine the gate diameter use the part wall section and the flow rate of the material.

As shown below, as the material flow rate decreases the size of the gate diameter increases. Use the table below as a guide in addition to your knowledge and experience with the material you are moulding.

High flow →		Medium flow →		Low flow
0.6 x part wall	0.7 x part wall	0.8 x part wall	0.9 x part wall	1.0 x part wall

The gate diameter should never be larger than the part's nominal wall section. As the pressure drop is generated by the melt viscosity and the wall section of the part. In fact, oversized gate diameters will generally result in longer cycle times and poor vestige as the gate diameter is the last place to cool to the ejection temperature.

Decreasing the Gate Land

Mastip does not recommend a gate land less than 0.05 mm due to dramatically reduced gate life and lack of steel at the gate to cool the plastic.

The gate land can be decreased to create a more cosmetic gate. Below are some rough guidelines.

Gate Land ('q') Size	Cosmetic Gate?	Life of Gate Land	Other Factors
0.20 mm*	No	longer life	Engineering materials with GF content
0.15 mm	Medium	shorter life	Medium GF
0.12 mm	Good	shorter life	Good cavity steel required to minimise gate wear

Gate Land ('q') Size	Cosmetic Gate?	Life of Gate Land	Other Factors
0.08 mm	Excellent	shortest life	Stavax or similar cavity steel required. Circular water-cooled inserts recommended.

* This is the MAXIMUM gate land recommended by Mastip.

Increasing the Gate Land

The gate land ('q') maximum is 0.2 mm for proper nozzle function.

If you enlarge the gate diameter ('G') then you must modify the gate profile to maintain the correct gate land ('q'). You may correct the gate land ('q') by machining the internal 90° angular face.

Enlarging the gate land ('q') will:

- Increase the heating effect around the gate, possibly burning the material.
- Decrease the flow.
- Increase the pressure drop across the gate.
- Cause the gate to freeze off prematurely.
- Leave an enlarged gate mark.

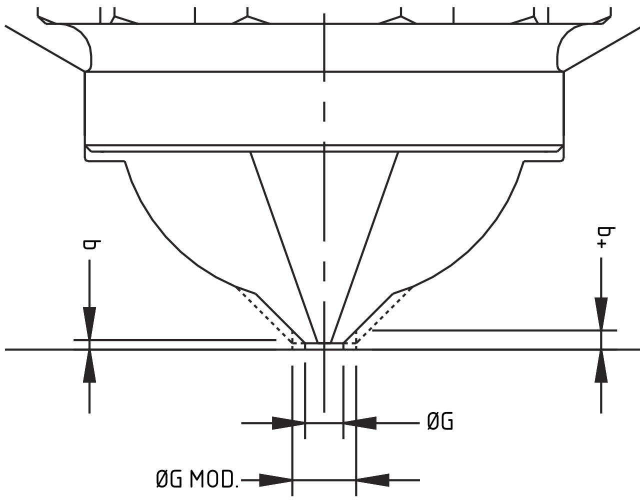

Figure 3: Increasing the Open Nut Gate Land

Figure 3 demonstrates the effect of increasing the gate diameter ('G') on the gate land ('q' becomes 'q+'), as represented by the dotted lines.

Mastip supplies all bush nuts with a parallel gate diameter ('G') and a 0.2 mm gate land ('q').

Modifying the Sprue Nut

You MUST modify the sprue nut to suit your application. Below are two examples of sprue nut modifications and Mastip recommends the Shaped Spure. The nut contact (measurement 'H') should also be tuned to suit your required cycle times and cooling.

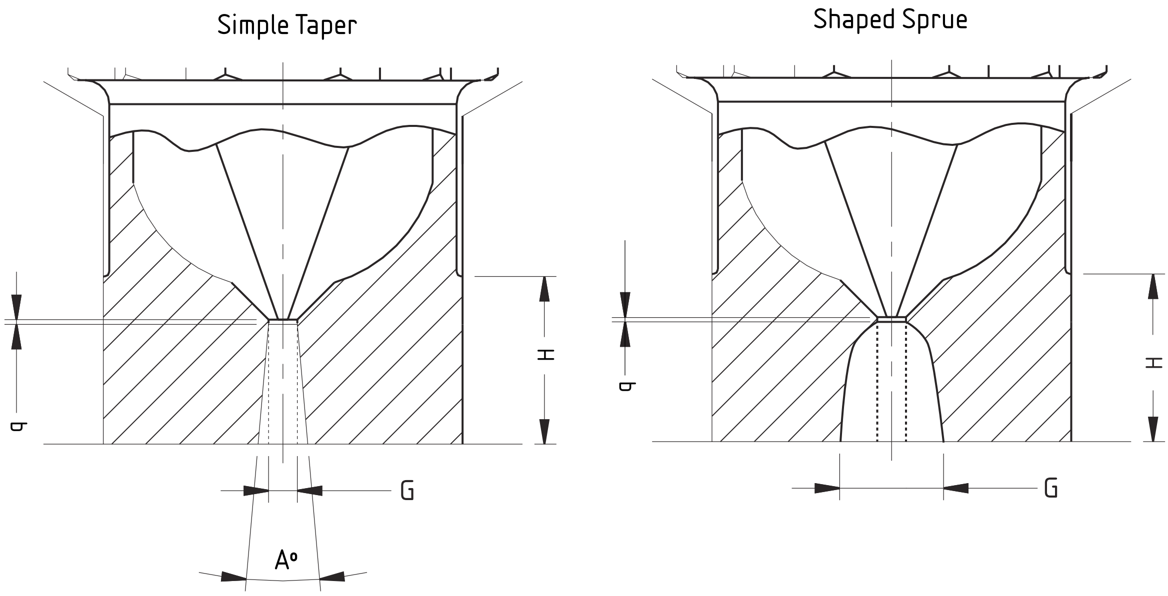

Figure 4: Sprue Nut Gate Land Modification Examples

The standard Mastip sprue nuts are supplied with a parallel gate hole ('G') 5.2 mm deep (shown in Figure 4 with dotted lines). After you modify the nuts, nitrate the nuts to increase the nut life. See the Decreasing the Gate Land section for information on different 'q' values.

Caution: Use conventional machining and not EDM to modify to the Sprue Nut. EDM causes the steel surface to harden and become brittle, which may lead to cracking and failure of the gate.

System Expansion

As the Hot Runner System and mould operating temperatures are extremely different, thermal expansion allowance must be built into the manifold and nozzle pockets in the cold condition. If the expansion calculation is incorrect the Hot Runner System and/or the mould may be damaged, and can leak. Mastip manifolds have steel spacers that can be ground with the correct expansion allowance.

Nozzle Expansion Calculation

To calculate the total nozzle cavity dimension, you must use the nozzle's temperature expansion value (E), its length (L), and its gate land (q). Use the equation below to determine total cavity depth.

Total Cavity Depth = L + E + q

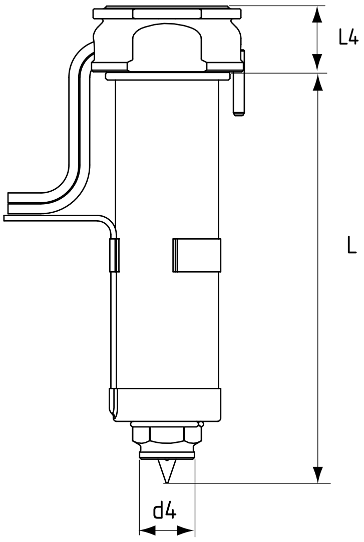

Figure 5: Nozzle Dimensions Needed for Calculating a Nozzle's Total Depth

Use the Mastip Nozzle Catalogue to locate the nozzle length (L) and use the following equation to determine the nozzle's temperature expansion value (E).

E = L * k * (nozzle temperature ºC - mould temperature ºC)

Nozzle Expansion Example

To find the temperature expansion value for a nozzle with the following information:

Variable	Value
MX 13115 nozzle length (L)	115
k	0.0000132
gate land (q)	0.2 mm
nozzle temperature	230°C
mould temperature	40°C

E = 115 * 0.0000132 * (230 - 40)

E = 0.29 mm

With a temperature expansion value of 0.29, you can calculate the total depth of the nozzle cavity:

Total Depth = L + q + E

Total Depth = 115 + 0.2 + 0.29

Total Depth = 115.49 mm

Manifold Pocket Thermal Expansion Calculation

Thermal Gate Nozzles

In this method, you grind the steel spacer to suit.

You need the following measurements to calculate the manifold pocket thermal expansion allowance:

- The manifold and the nozzle head height heights.
- The nozzle cavity height (that is, the height from B to the back plate).
- The Hot Runner System operating temperature and the mould temperature.
- The titanium spacer heights.

NOTE: The height of the steel and titanium spacer will measure more than is shown on the Mastip approval drawing. Mastip supplies the steel spacer with 0.3 mm grinding allowance to ensure the correct allowance is added.

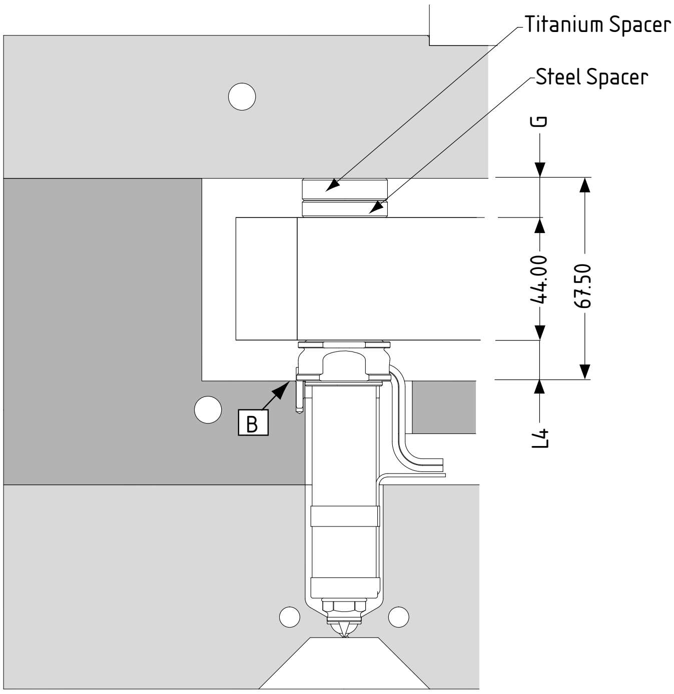

Figure 6: Measurements Needed for Manifold Expansion Calculation (Thermal Gate)

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Thermal Expansion for Thermal Gate Example

Use Figure 6 and the following measures for this example:

Description	Symbol	Value
Nozzle Head Height from the Mastip catalogue (for a MX 16115 nozzle)	L4	12.0 mm
Manifold thickness	M	44.0 mm
Titanium Spacer	t	6.5 mm
Steel Spacer	s	To be calculated
Nozzle and Manifold Temperature	Tman	230°C
Mould Operating Temperature	Tmould	40°C
Manifold Top Clearance	G	11.5
Rate of thermal expansion	k	0.0000132
Interference	i	0.05 mm

Step 1: Calculate Total Cavity Depth (D)

D = L4 + M + G

D = 12 + 44 +11.5

D = 67.5 mm

Step 2: Calculate Thermal Expansion (E)

E = ((L4/2) + M + (G/2)) * k * (Tman - Tmould)

E = ((12/2) + 44 + (11.5/2)) * 0.0000132 * (230-40)

E = 55.75 * 0.0000132 * (190)

E = 0.140 mm

Step 3: Calculate the required cold height (C) of the system (manifold, nozzle head, spacers)

C = D + i - E

C = 67.5 +0.05 - 0.140

C = 67.41 mm

Step 4: Calculate required steel spacer thickness (s) after grinding

s = C - (M + L4 + t)

s = 67.41 - (44 + 12 + 6.5)

s = 67.41 - 62.5

s = 4.91

Customer should grind the steel spacer to 4.91 ±0.005.

Valve Gate Nozzles

In this method, the pocket is machined to suit.

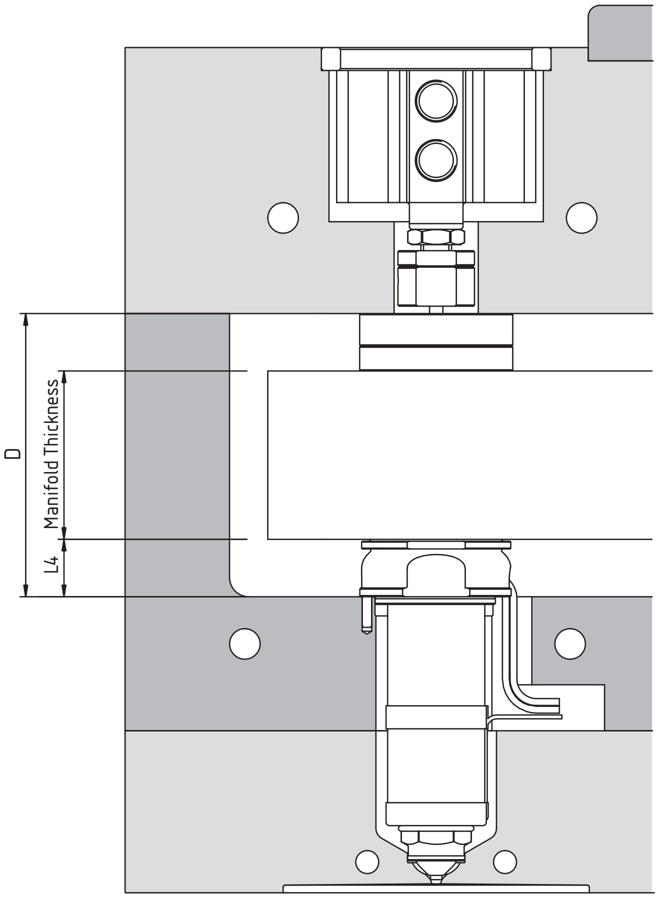


Figure 7: Measurements Needed for Manifold Expansion Calculation (Valve Gate)

Description	Symbol	Value
Nozzle head height (from the Mastip catalogue for a MX16095 Nozzle head)	L4	12 mm
Manifold Thickness	M	44 mm
Titanium Spacer	t	6.5 mm
Steel Spacer	S	8.5 mm
Manifold Temperature	Tman	260°C
Mould Operating Temperature	Tmould	60°C
Interference	i	0.05 mm
Rate of thermal expansion	k	0.0000132 mm
Measured Pocket Depth	D	To be calculated

Thermal Expansion for Valve Gates Example

Step 1: Calculate Expansion (E)

E = ((L4/2) + M +(S/2) + (t/2)) * (Tman - Tmould) * k

E = (6 + 44 + 4.25 +3.25) * (260-60) * 0.0000132

E = 57.5 *200 *0.0000132

E = 0.1518 mm

Step 2: Calculate Manifold Cavity Depth (D)

D = L4 + M + S + t + E - i

D = 12 + 44 + 8.5 + 6.5 + 1.518 - 0.05

D = 72.468 mm

Customer should machine manifold cavity depth to 72.468 $^{+0.00}_{-0.01}$

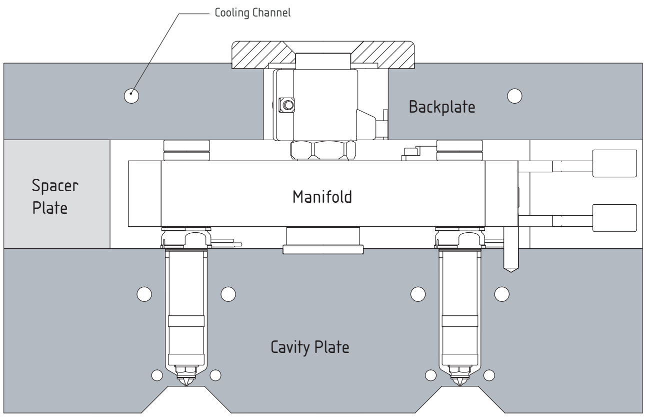
Mould Construction

When constructing a mould, you must consider the back plate clamping, mould cooling, and wiring.

Mould Construction Examples

Spacer Plate Layout

- Basic layout for easy manufacturing of fixed cavity side
- The back, spacer, and cavity plates are separate.
- No split line for nozzle maintenance.
- Weak mould construction due to lack of support in the centre of the mould.
- Mastip does not recommend this type.

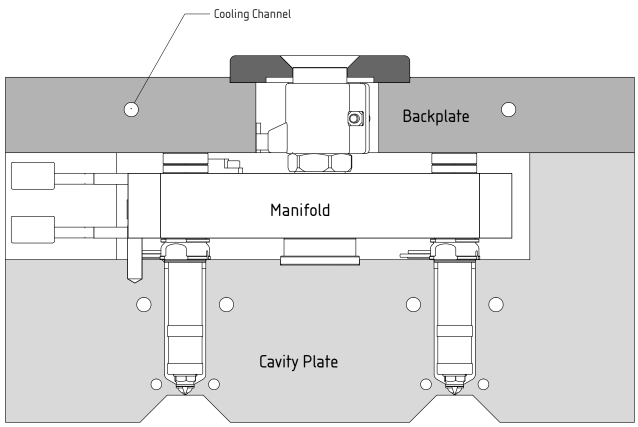


Not Recommended

Figure 8: Spacer Plate Layout

Manifold Cavity Layout

- Simple layout of fixed cavity side requires relatively easy manufacturing.
- Hot Runner cavity is machined into the cavity plate.
- The back and cavity plates are separate.
- No split line for nozzle maintenance.
- Mould strength dependent on Hot Runner pocket and amount of support added.



Acceptable

Figure 9: Manifold Cavity Layout

Hot Half Layout

- Complex layout for fixed cavity side requires more manufacturing time.
- Hot Runner cavity is machined into the cavity plate.
- The back and nozzle cavity plates are separate.
- Split line added for nozzle maintenance.
- Mould strength dependent on Hot Runner pocket and amount of support added.

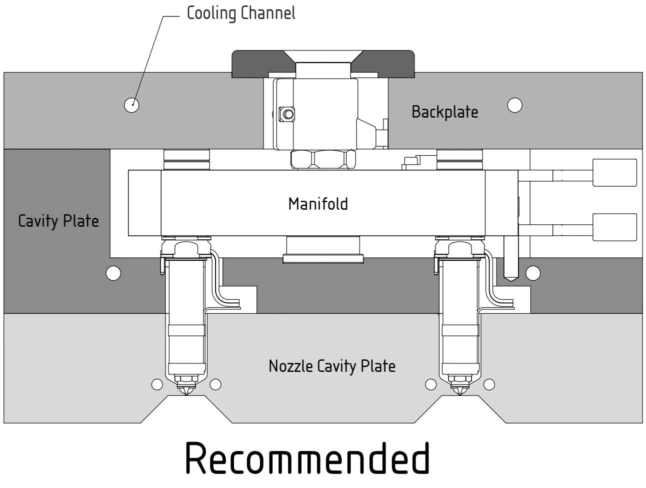


Figure 10: Hot Half Layout

Mould Design for Valve Gate Applications

Figure 11 is a valve gate system in a mould.

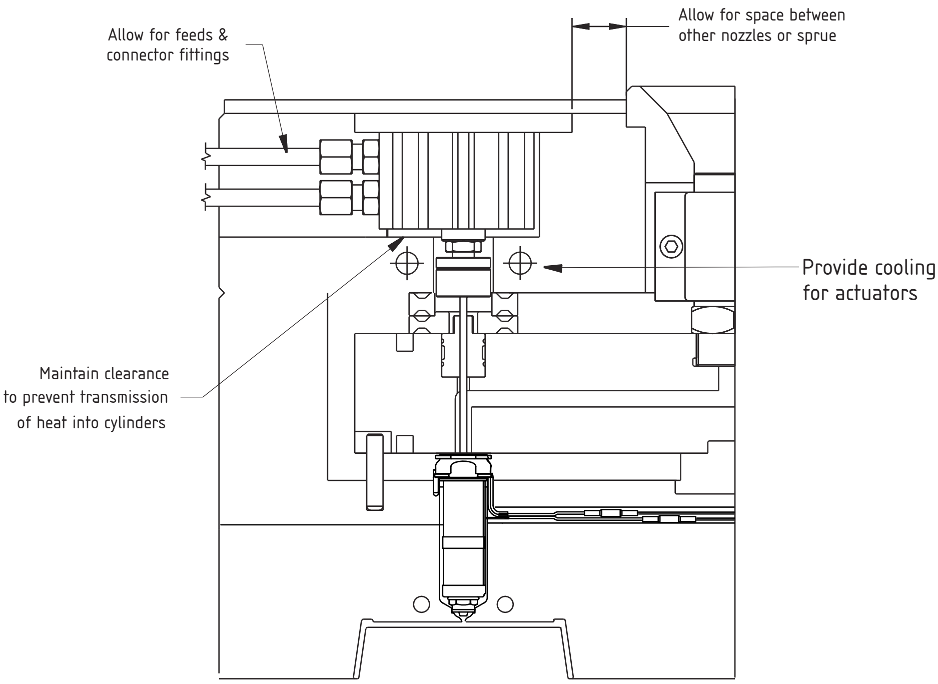


Figure 11: Mould Modifications for Valve Gate Applications

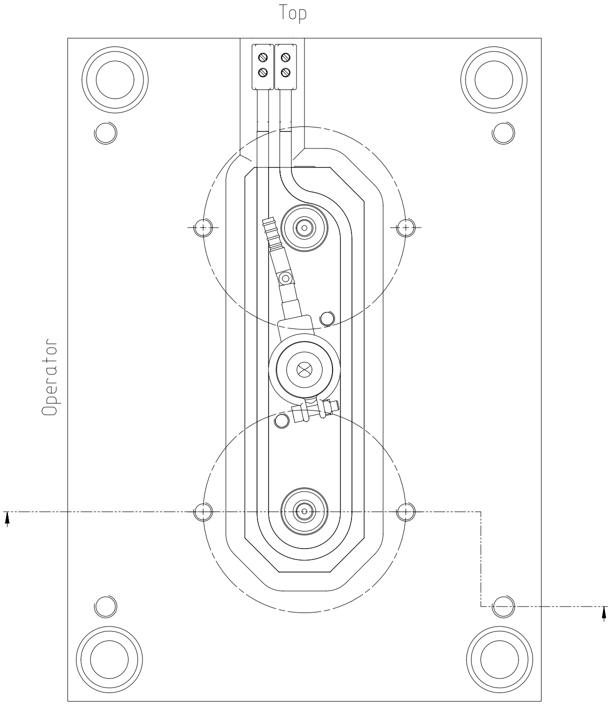
When designing a mould for a valve gate application, you must:

- Make the Back Plate thicker to mount the actuators.

- Add channels to the mould for pneumatic or hydraulic feeds to actuators (for example, fittings, piping).
- Allow sufficient distance between nozzles to mount cylinders and the cylinder back plates.
- Provide cooling in back plate to reduce cylinder temperatures. This will prolong the life of the seals and avoid the cylinder mechanism binding from excessive thermal expansion.

Back Plate Clamping around a Manifold

Clamping bolts are required to help the mould resist movement due to injection pressure and thermal expansion of the manifold and nozzles.



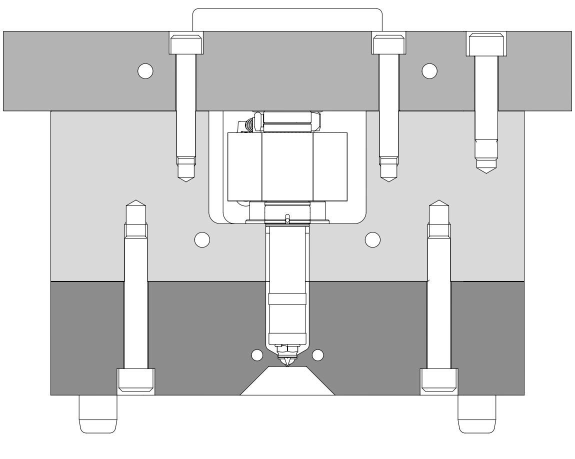


Figure 12: Suggested Placement of Clamping Bolts

- Mastip recommends a minimum of two bolts per drop, placed as close as possible to the drop.
- The size of clamping bolt depends on the size of the system, injection pressure, and grade of bolt.
- High tensile bolts must be used.

- Keep clamping bolts as close as possible to the drops to ensure good sealing.
- Do not expose clamping bolts to direct heat from manifold.

Cooling

Adequate cooling for the mould is essential to remove heat and achieve acceptable cycle times. Two areas need be cooled: the gate and the plate.

Heat is added to the mould by convection and conduction from the Hot Runner System, and by the molten plastic entering the mould cavity. If not removed, this additional heat can result in incorrect thermal expansion allowances in the mould. Incorrect thermal expansion can result in:

- leaking from the Hot Runner System,
- dimensional instability in the moulded parts,
- longer cycle times, and
- damage to the mould components and moving parts where clearances must be maintained.

Gate and Nozzle Cooling Styles

Note: Ensure that gate cooling channels are on a separate circuit from mould, plate and cavity cooling.

Efficient gate cooling is vital to obtain the best performance over the widest moulding window. While insufficient cooling of the gate may result in the gate drooling/stringing and increased cycle times.

You must cool the plates surrounding the hot runner nozzles.

Simple Cooling Channels

- Cooling channels are drilled around the nozzle.
- Difficult to provide cooling directly to the gate.
- Cooling may be biased more to one side of the nozzle.
- Acceptable where gate cooling and lower cycle times are not important.
- Low level of manufacturing required.

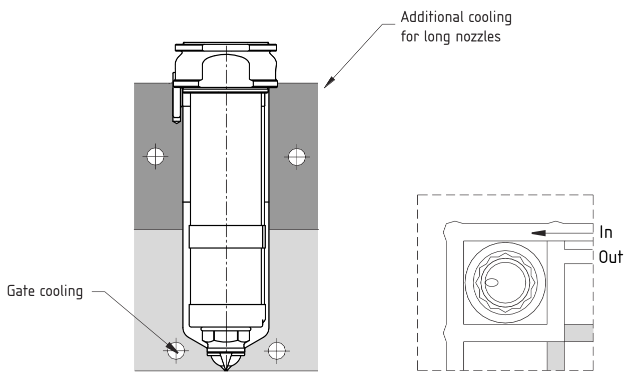


Figure 13: Cooling Channels Example

Insert with Cooling Channel Groove

- For application where good gate cooling is required.
- Requires manufacturing of inserts for nozzles.
- Extra nozzle retaining plates may be added to the tool, to aid maintenance and manufacture.
- Requires o-rings to seal cooling channels.
- Medium level of manufacturing required.
- May leave insert witness mark on the part.

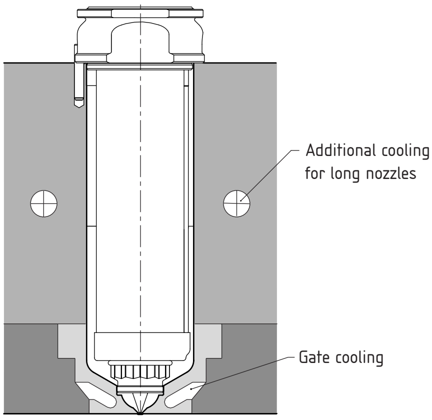


Figure 14: Insert with Cooling Channel Groove Example

Insert with Helical Cooling Channels

- Helical cooling channel in insert provides an excellent level of cooling directly to the gate.
- For application where a high level of cooling is required to the gate area.
- Requires manufacturing of inserts for nozzles.
- Extra nozzle retaining plates may be added to the tool to aid manufacturing and maintenance.
- Requires o-rings to seal cooling channels.
- High level of manufacturing required.
- May leave insert witness mark on part.

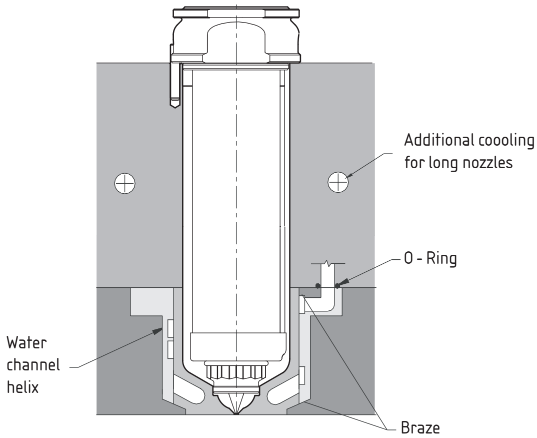


Figure 15: Insert with Helical Cooling Channels Example

Plate Cooling

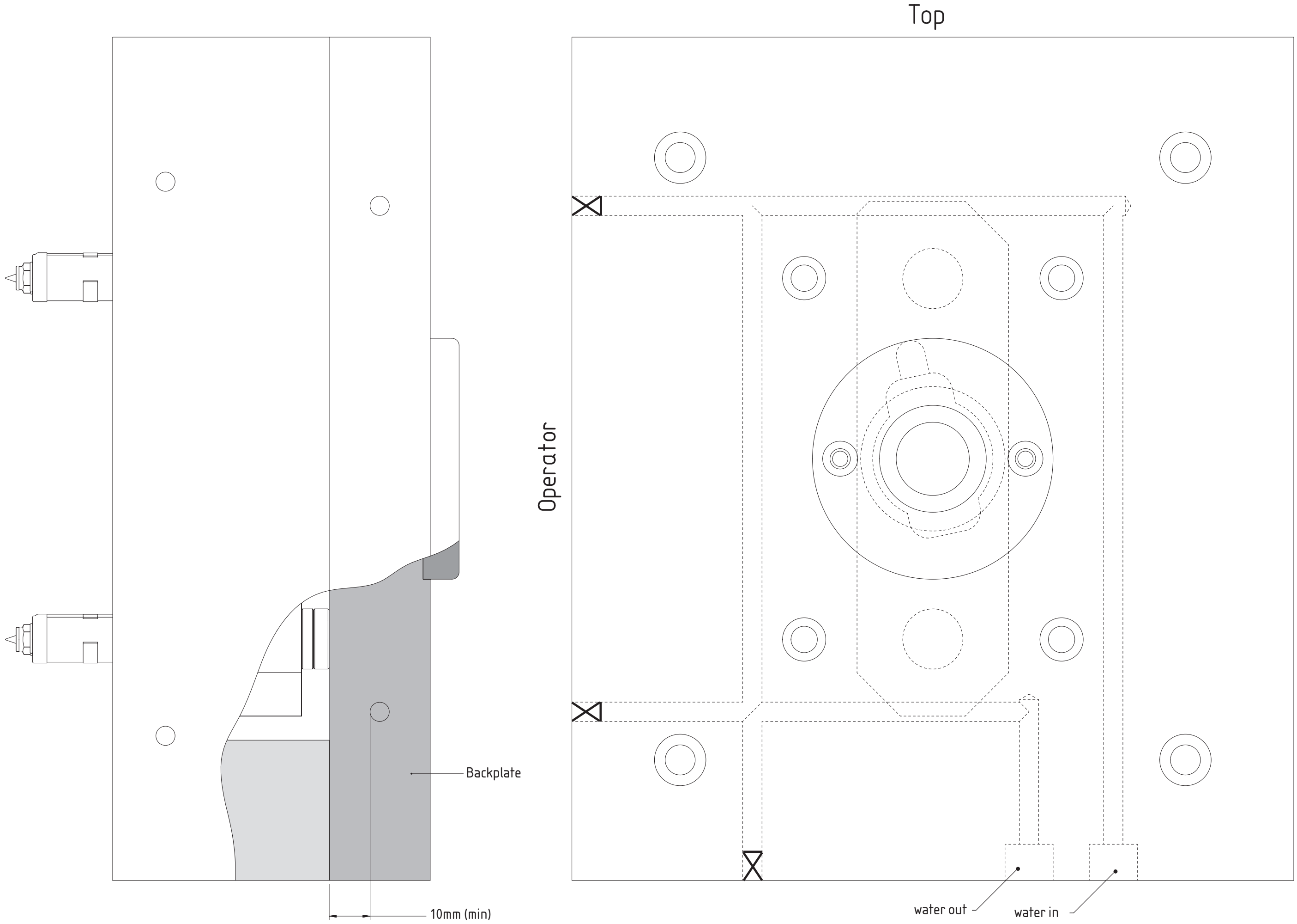


Figure 16: Typical Cooling Channels in the Back Plate of the Tool

Heat can also be transferred to the injection moulding machine, causing inaccuracy and mechanical instability.

When adding cooling:

- Provide sufficient cooling to the Back Plate, Manifold plate, Nozzle plates, and the gate to ensure optimal performance of the Hot Runner System.
- Place cooling channels to provide uniform cooling.
- When using valve gates, supply cooling around the cylinders to improve seal life and avoid seizing due to excessive expansion of the cylinder components.
- Place cooling entry and exit connections far from all electrical components.

Cooling the back plate is integral to minimising heat transfer to the moulding machine.

Hot Runner System Wiring

The wiring slots for the nozzles must be of sufficient size to accommodate the wires. Refer to the Mastip nozzle catalogue for information on wires. Especially note the length required to accommodate the nozzle heater ferules.

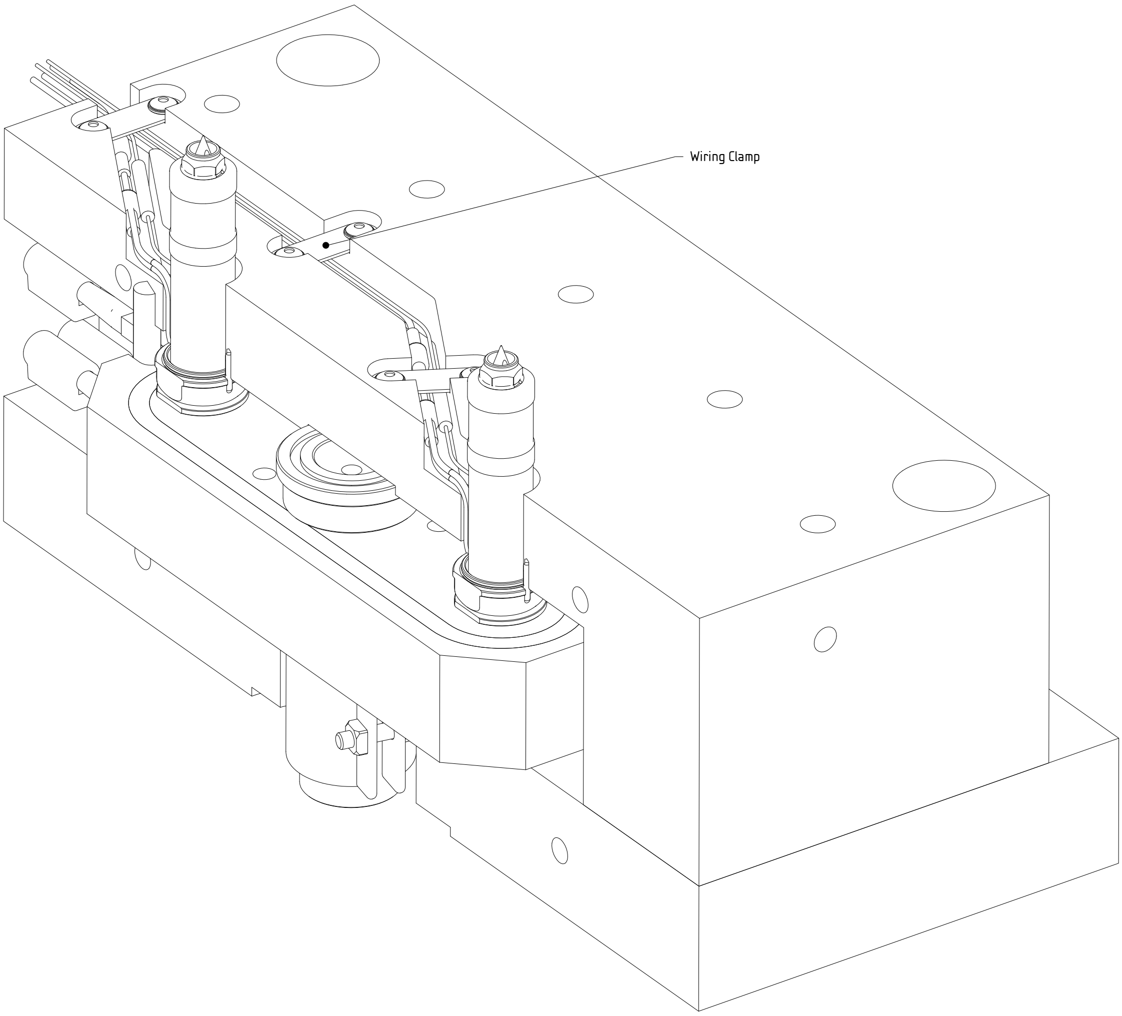


Figure 17: Manifold Wiring Diagram (Cutaway view)

If heater wiring is to be bent, allow sufficient room.

Where the wiring troughs meet, create a larger slot to accommodate the bundled mass of wires

For maximum manifold life and reliability, or where running temperatures for the manifold are above 260ºC, use a shield to cover the wiring channels and protect the wires from the heat.

Make sure there are no sharp edges to damage the nozzle wires. Do not crush wires.

Allow a cutout for wiring to enter the mounting box.

Never rotate the nozzle by the heater or thermocouple wires.

Clamp wires in place as demonstrated in Figure 17, as loose wires can come in contact with the hot manifold and be damaged.

Zone Numbering

Mastip uses the following numbering system for nozzles within the Hot Runner system: numbering starts in the upper left corner and in zig-zag fashion until all nozzles are numbered.

See Figure 18 for an example in a 16 drop system.

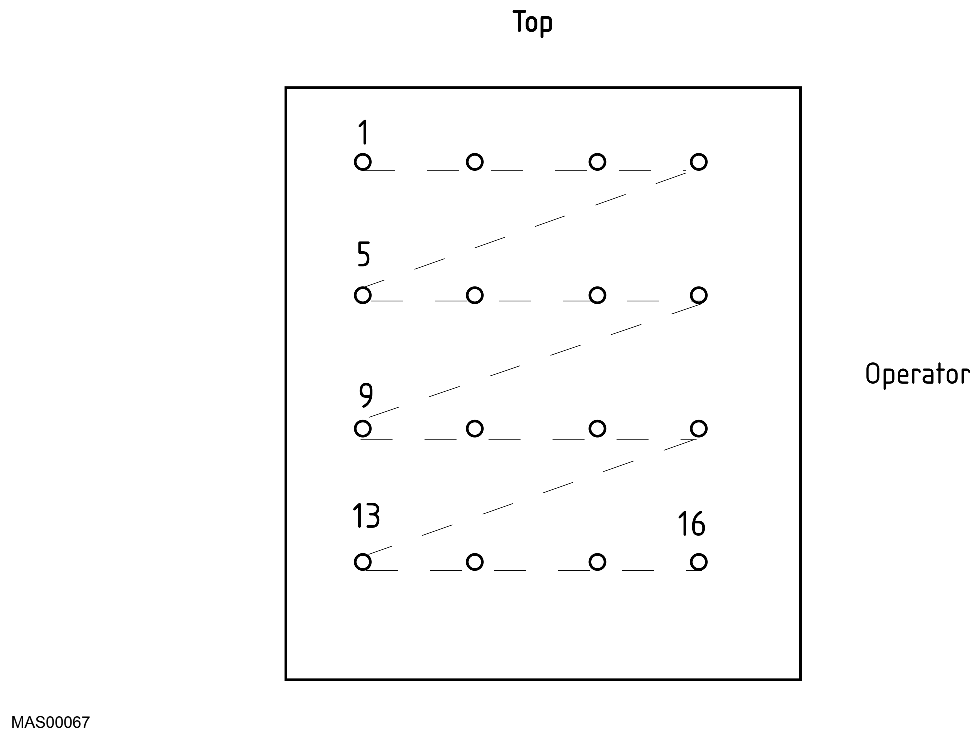


Figure 18: Example of Zone Numbering in a 16 Drop System

Nozzle Machining Tolerances

BX, MX, and SX Nozzles

See the Nozzle Catalogue for the machining tolerances of the X Range nozzles. The tolerances are included in the Nozzle Fitment and Gate Dimensions section.

MT Nozzles

Figure 19 lists the machining tolerances for the MT range of nozzles.

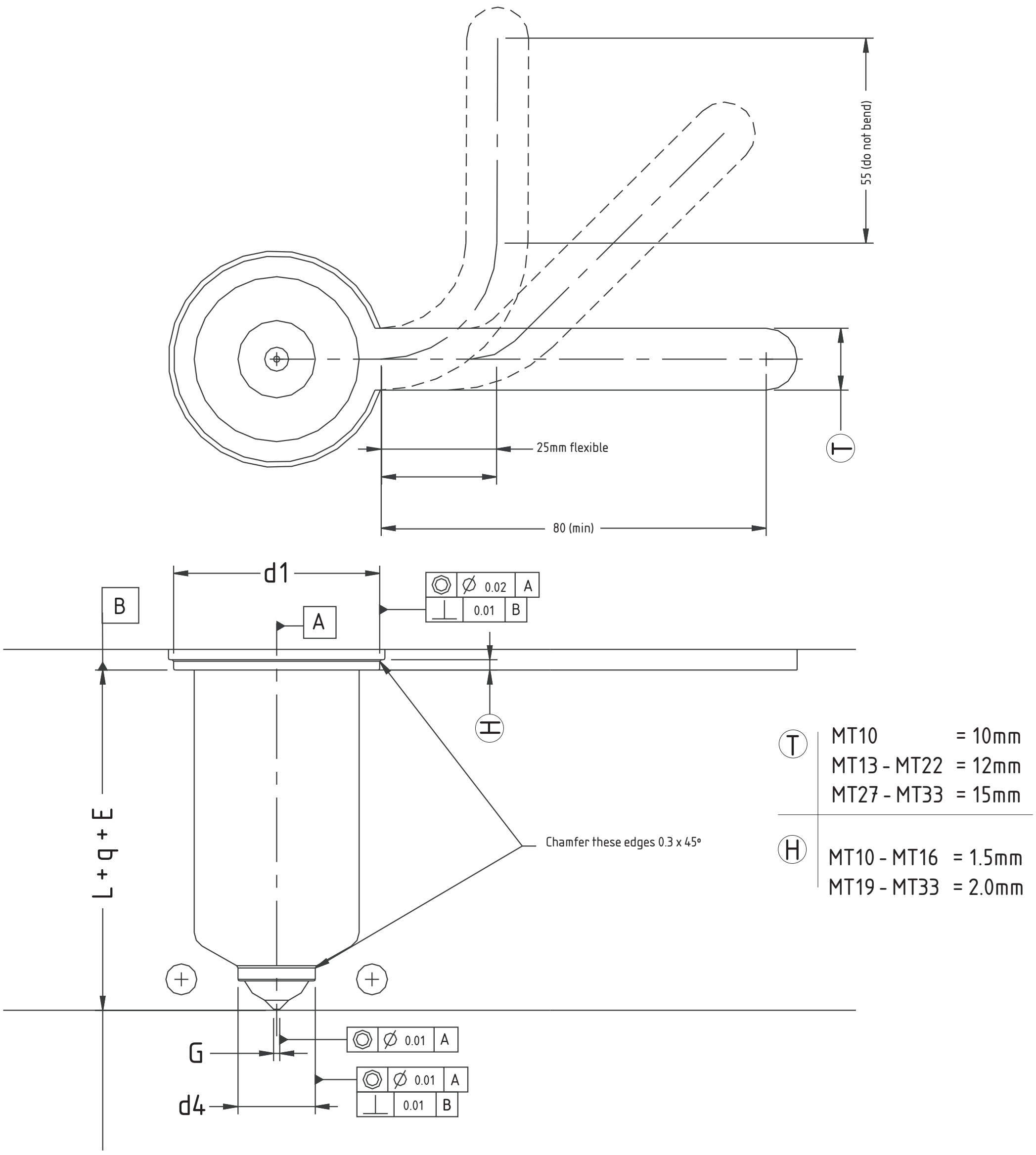


Figure 19: MT Range Nozzle Installation Tolerances

For the best results, machine the nozzle seat directly into mould.

Ensure minimal heat loss and easy removal by making the pocket for the nozzle head stepped and maintaining the correct dimension for H. (See Figure 19.)

Keep the wire channel straight for 55 mm to allow for the heater ferrule. The channel may be curved before or after this portion.

To maintain consistent operation, ensure:

- Concentricity between G and d4
- Perpendicularity between d4 and B
- Concentricity between d1 and d4
- Sizing of d4 is important to prevent leaks

Chamfer points indicated to aid in fitting the nozzle.

Installation

Preparing the System for Installation

- Check that the plates' dimensions are correct and ensure there is adequate cooling. For a valve gate system, ensure that all dimensions are correct for the valve cylinder and air tubes.
- Check all nozzle dimensions and record them for future reference.
  A copy of the nozzle check sheet is available at www.mastip.com
- Cavity details (as shown in the Nozzle catalogue) ensure that contact is kept to a minimum. Use the measurements in the catalogue and allow for expansion. Use the product models on the Mastip website for reference, but the models do not account for expansion. See Nozzle Expansion Calculation section for more information.

Preparing a Nozzle for Installation

Prior to installing the nozzles, check the following:

- Handle nozzles carefully.
- Remove the protective oil from the nozzles.
- Check that the nozzle cavity dimensions are correct, especially the gate area. Allow for nozzle expansion. See the Nozzle Expansion Calculation section.
- Check the ball height to ensure it is as indicated in the Nozzle Catalogue.
- Visit http://www.mastip.com/uploads/CalcGateSingle.aspx.
  Use the expansion calculator at to check your calculations.

Installing BX Nozzles

Step 1: Fit the dowel(s) in the dowel hole(s) in the Cavity Plate.

Step 2: One-by-one fit the nozzles into the Cavity Plate.

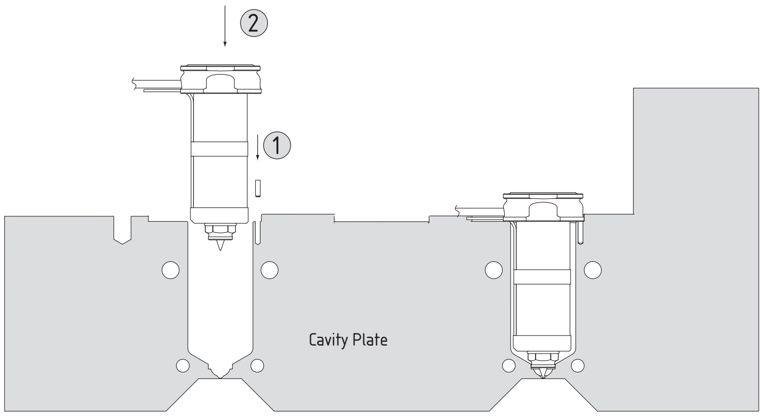


Figure 20: Insert BX Nozzles

Step 3: Check that all nozzle sealing faces are level within 0.02 mm.

Step 4: Clip the wires to the Cavity plate to prevent the wires from touching the manifold.

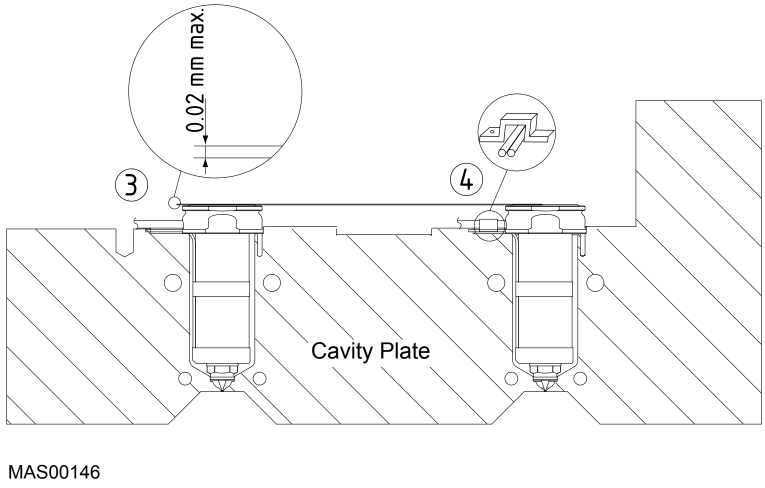


Figure 21: Check BX Nozzle Installation

Installing SX Nozzles (Single Nozzle Application)

Step 1: Place the Back plate on top of the Cavity plate.

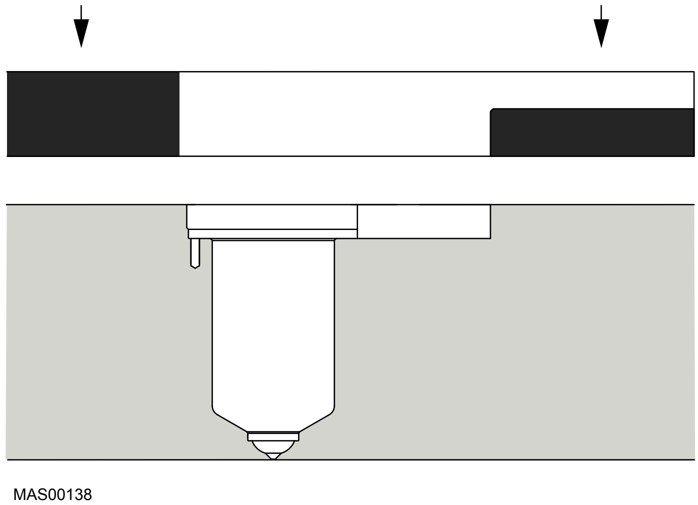


Figure 22: Place Back Plate in SX Nozzle Assembly

Step 2: Carefully bend the heater and T/C wires. **Do not to exceed** the bend radius specified.

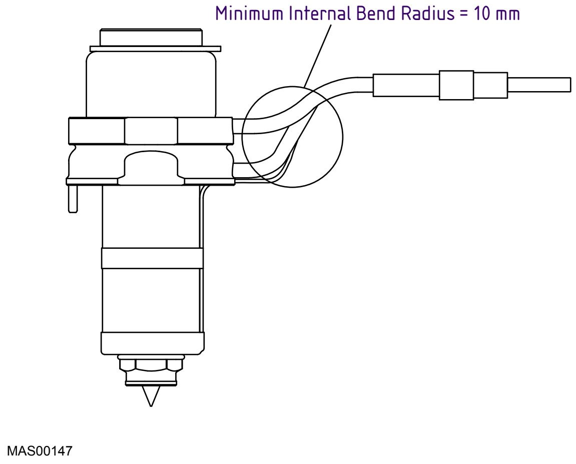


Figure 23: Bend SX Nozzle Wires

Step 3: Fit the dowel into the dowel hole in the Cavity plate.

Step 4: Insert the SX nozzle into the Cavity plate. It should be a slide fit.

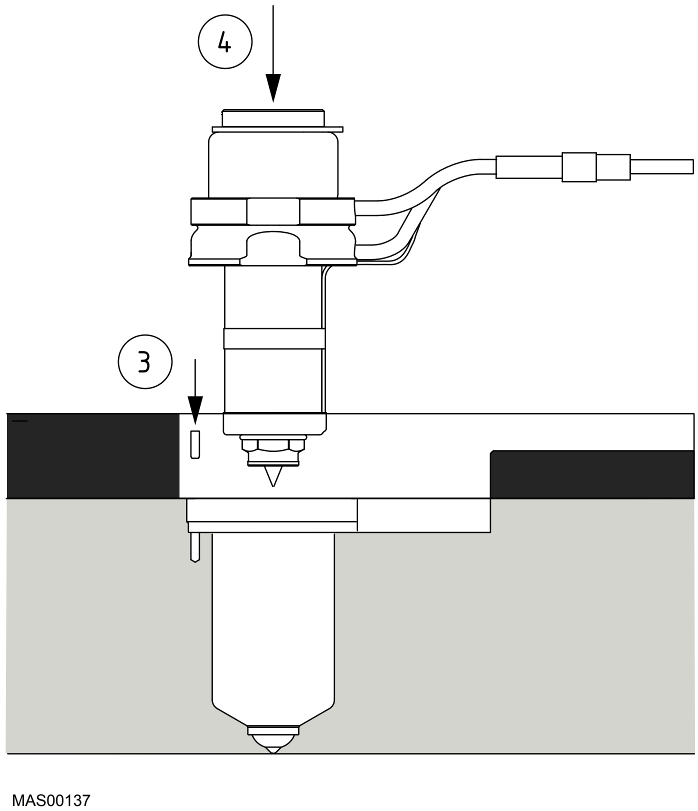


Figure 24: Insert Dowel and SX Nozzle

Step 5: Attach wire clips over the wires.
Do not crush wires.

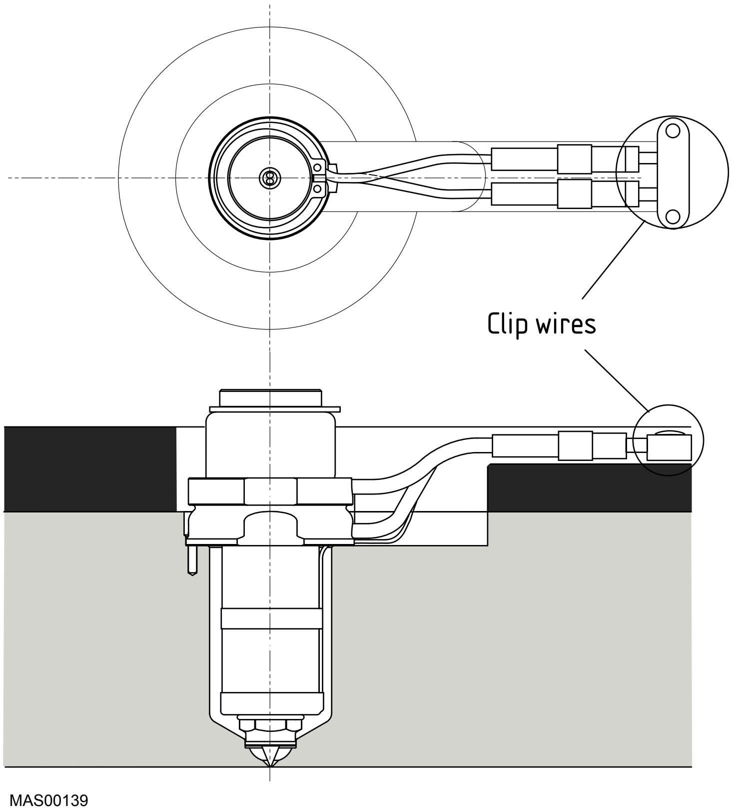
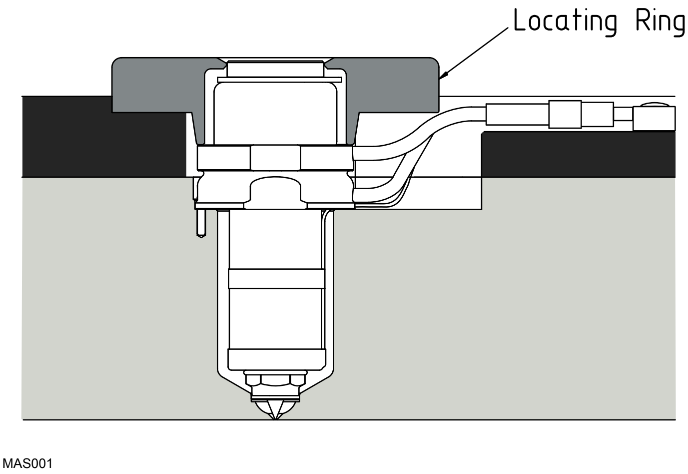


Figure 25: Clip SX Nozzle Wires

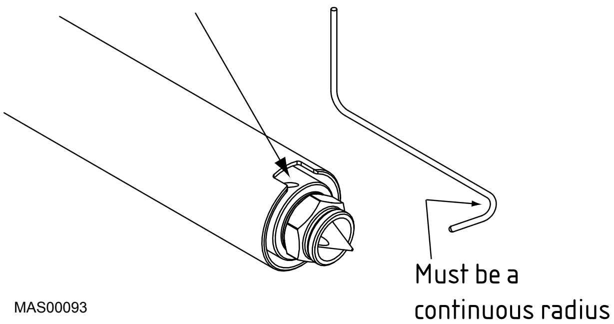


Step 6: Fit the Locating Ring and tighten retaining screws.

Step 7: Check the locating ring clearances.

Figure 26: Check SX Nozzle Locating Ring Clearances

Installing MX Nozzles into a Hot Half



Step 1: Insert the thermocouple (T/C) in the hole near the nozzle tip and bend it over the heater.

Figure 27: Install Thermocouple on MX Nozzle

Step 2: Bend the heater wires as shown above.

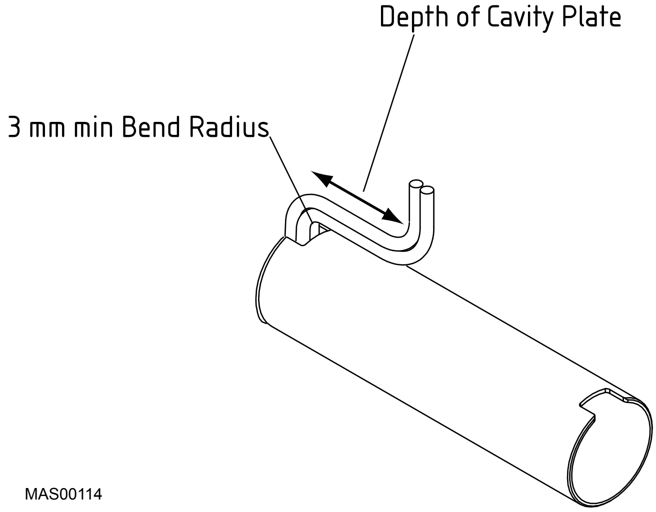


Figure 28: Bend MX Heater Wires

Step 3: Fit dowel(s) in the dowel hole(s) in the Cavity plate.

Step 4: One-by-one insert the nozzle bodies into the Cavity plate. Check that all nozzles are level within 0.02 mm.

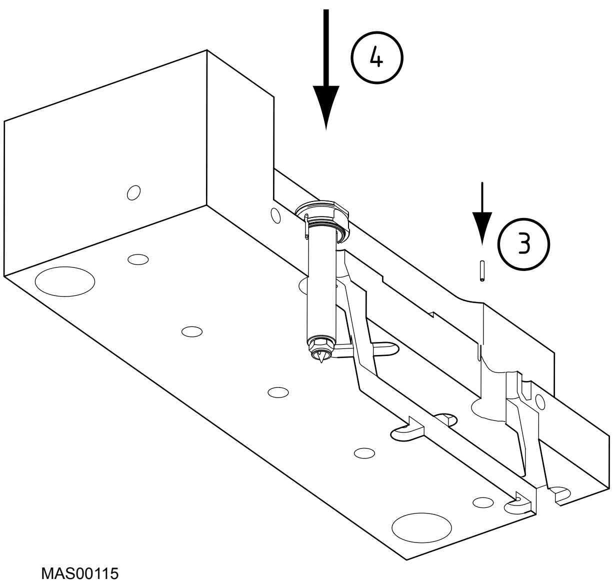


Figure 29: Insert Dowels and MX Nozzles

Step 5: Slide the heaters on to the nozzles and thread the wires through the wire channel.

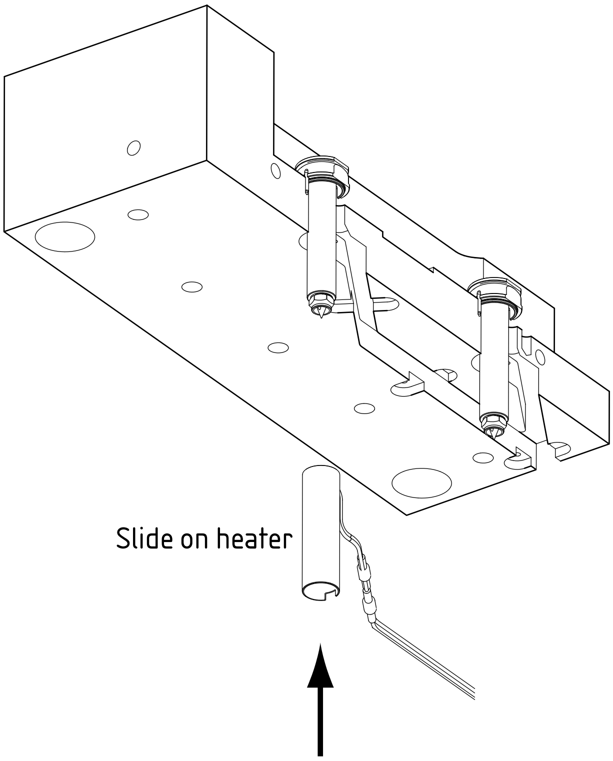


Figure 30: Slide on MX Heaters

Step 6: Install the T/C as shown above.

Step 7: Thread the T/C wires through the wire channels.

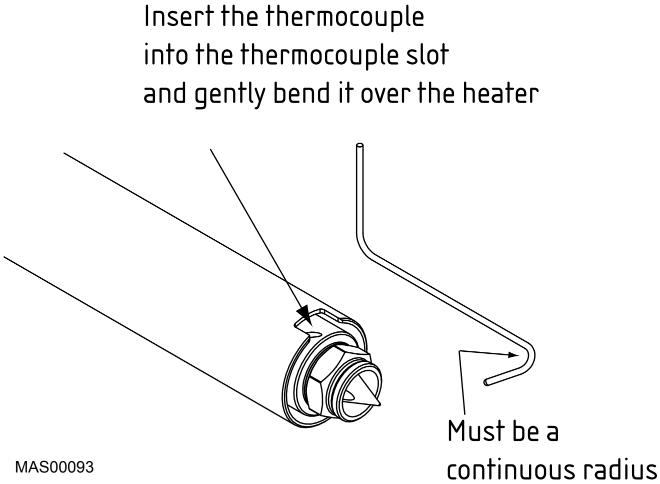


Figure 31: Insert MX Thermocouple

Step 8: Install the T/C clip (a), the heater cap (b), and the snap ring (c) (in that order).

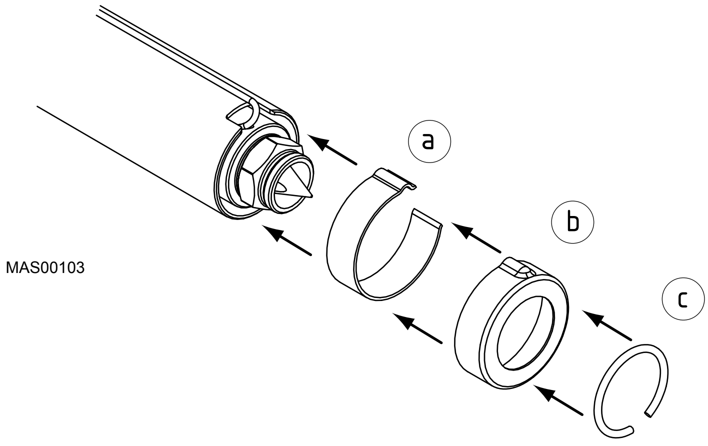


Figure 32: Finish MX Nozzle Installation

Step 9: Attach the wire clips over the wires in the wire channels. Do not crush wires.

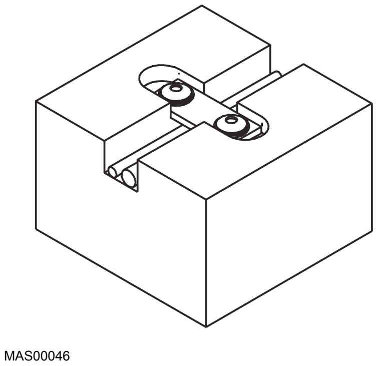


Figure 33: Example of Wire Clips

Installing MX Nozzles in a Rear-loading Manifold

Step 1: Insert the T/C in the hole near the nozzle tip and bend it over the heater as shown.

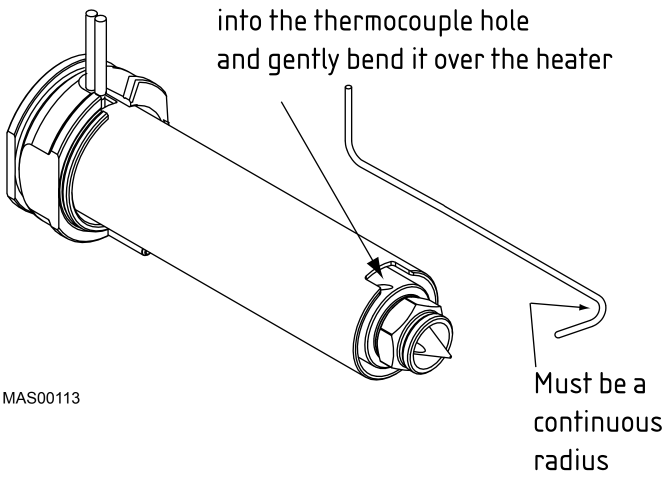


Figure 34: Insert Thermocouple on MX Nozzle

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Step 2: Bend the T/C along the outside of heater and bend it again with the heater wires at the nozzle head.

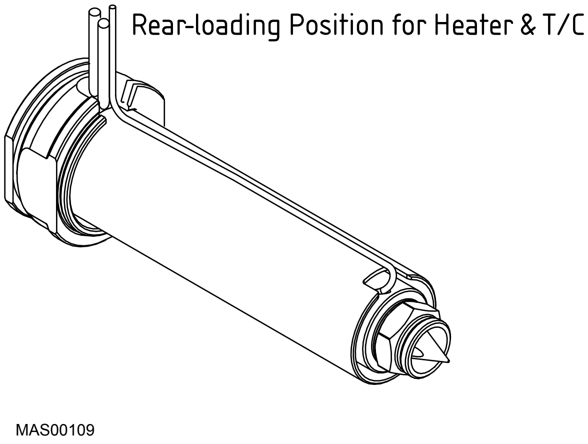

Figure 35: Example of Thermocouple and Heater Wires on MX Nozzle

Step 3: Install the T/C clip (a), the heater cap (b), and the snap ring (c) (in that order).

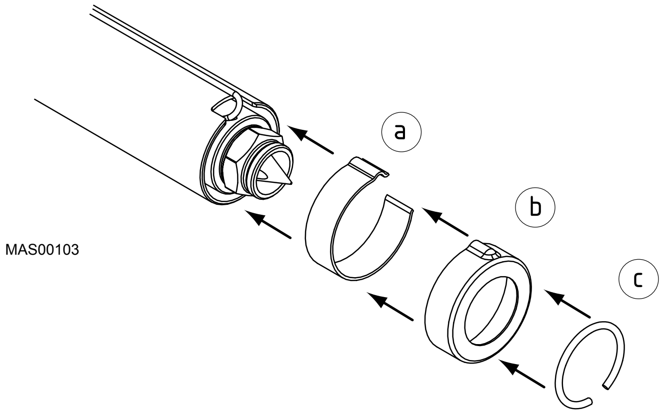

Figure 36: Finish MX Nozzle Installation

Step 4: Fit the dowel(s) in the dowel hole(s) in the Cavity plate.

Step 5: One-by-one fit the nozzles into the Cavity plate.

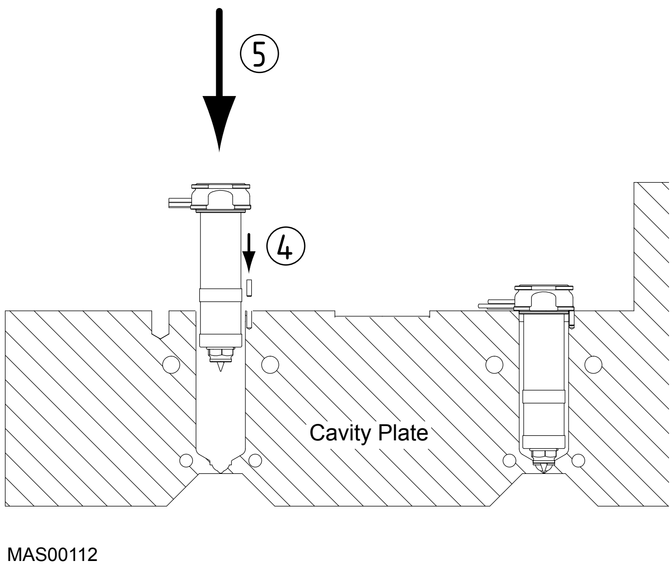

Figure 37: Insert Dowel and MX Nozzle

Step 6: Check that all nozzle sealing faces are level within 0.02 mm.

Step 7: Clip the wires to the Cavity plate to prevent the wires from touching the manifold.

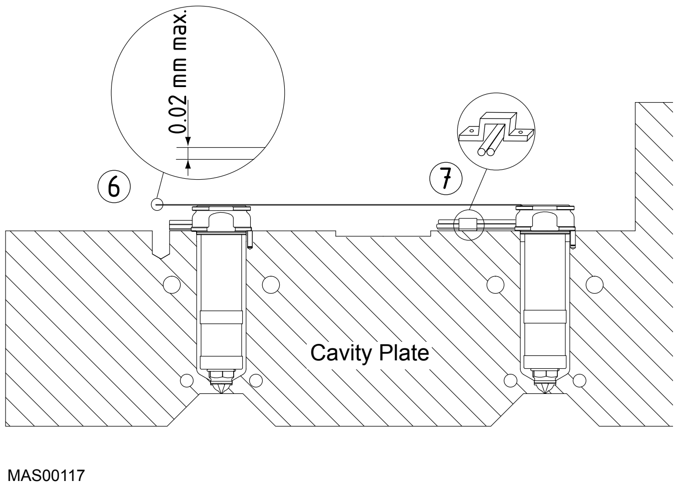

Figure 38: Check MX Nozzle Clearances

Installing MT Nozzles

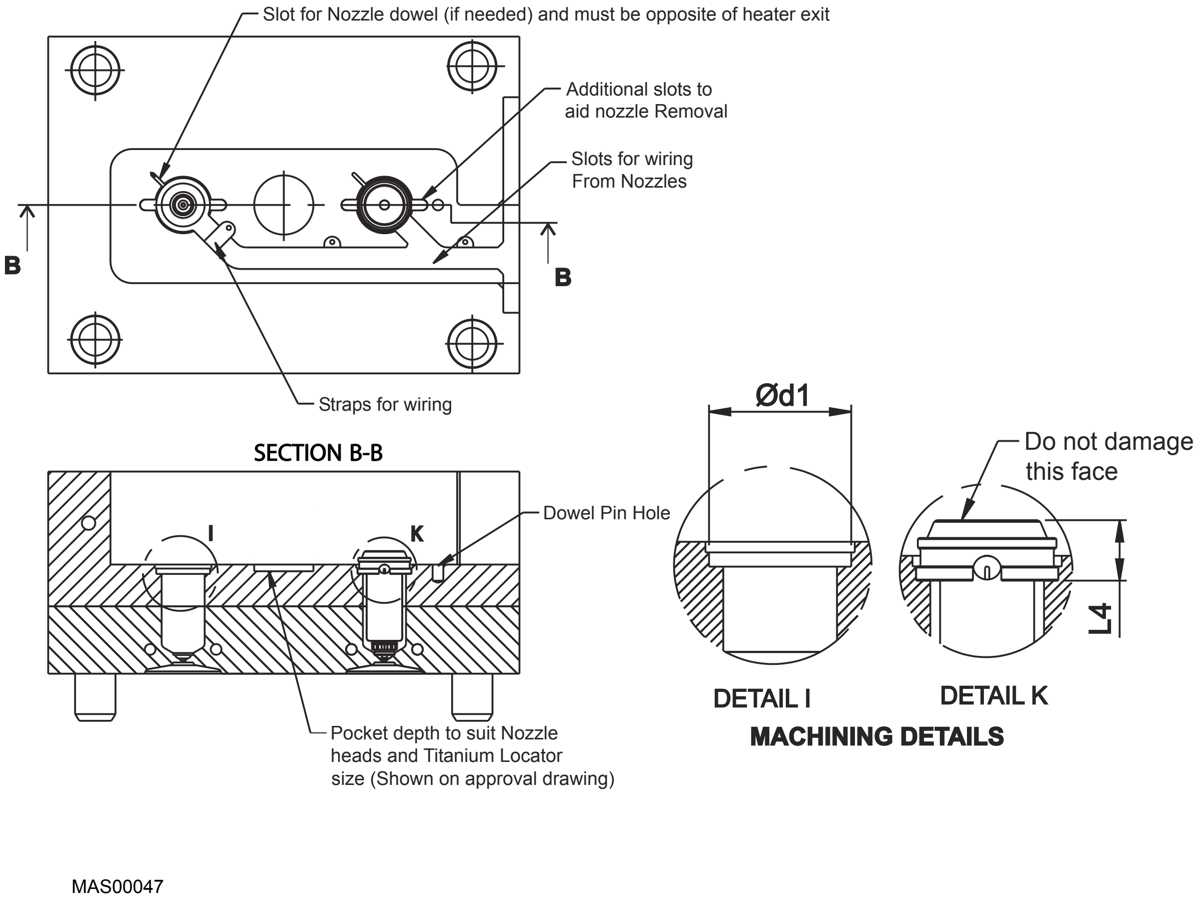

Figure 39: Detail of the MT Nozzle Range in Manifold

Note: Fit the nozzles one at a time, then check the height to the top of the back faces, they should all be equal to within 0.02 mm.

Introduce the nozzle into cavity until it is in contact with bottom sealing diameter and then gently press the nozzle to the pocket. Never use excessive force.

Installing a BX, MT, or MX Valve Gate System

Before you install the valve gate cylinder assembly within the tool, fit the hydraulic / pneumatic piping and fittings to the cylinder.

Notes for Hydraulic Cylinders

Note: Mastip recommends using quick connect fittings with shut-off to prevent hydraulic fluid losses when the mould is disconnected from the hydraulic power source.

- Always use solid piping whenever possible.
- Do not use more than 50 bar of pressure on the hydraulic cylinders to avoid damage.

Step 1: Install the Nozzles

Assemble the Mastip nozzle as per the Installing Nozzles section.

Step 2: Assemble the Valve Pin Seal, Titanium Spacer, and Steel Spacer

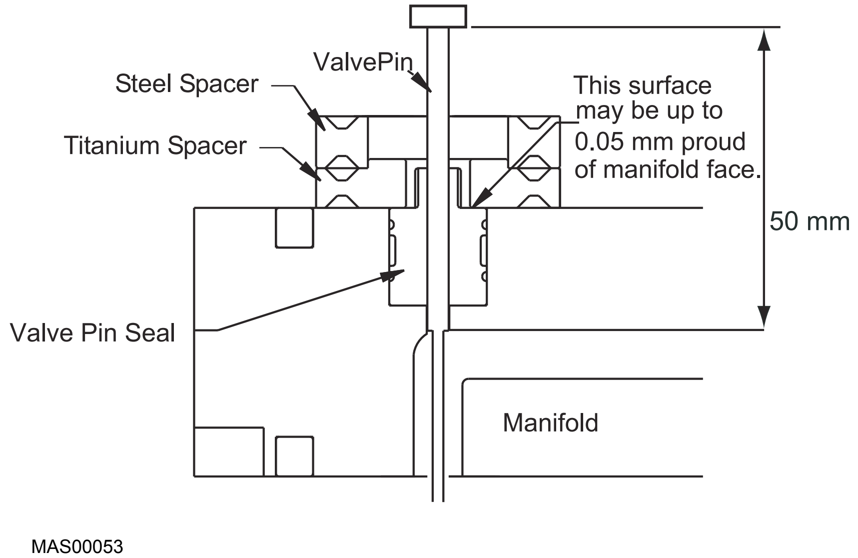

Figure 40: Assemble the Pin Guide Bush

Note: Pins and guides are matched and must be fitted as such.

Using Figure 40 as a guide, ensure that you:

- Fit the valve pin seal in the manifold bush hole. The top face of the seal should be slightly proud of the manifold top face (0.01-0.05 mm) to seal.
- Fit the valve pin in the valve pin seal. It should have a slight frictional resistance to the movement of the pin.

Step 3: Prepare and Assemble Valve Pin

1. Refer to pages VGA-2 through VGA-5 in the Valve Gate section of the Nozzle catalogue for the correct formula for the valve pin system you are using. Use the formula to determine the correct pin length.
2. Insert the shortened pin into the pin holder.
3. Recheck pin length.

Step 4: Assemble Valve Gate Cylinder

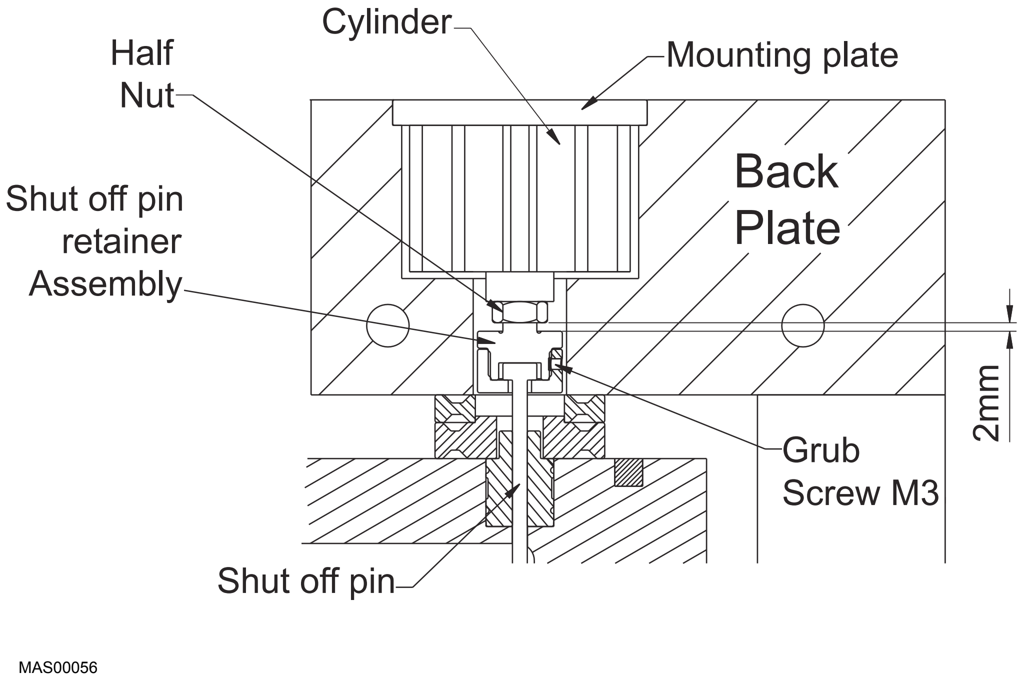

Figure 41: Valve Gate Cylinder Assembly

1. Assemble the valve gate cylinder assembly, which consists of:
   - shut off pin,
   - half nut (the half nut must have a 2 mm adjustment gap as indicated in Figure 41),
   - pin retainer assembly (pin retainer body and cap),
   - cylinder (hydraulic or pneumatic), and
   - mounting plate.
2. Place tool in position so the valve gate cylinder assembly can be fitted into the back of the tool, and the front face of the gate is visible.
3. Feed assembly through back plate, taking care not to damage the valve pin.
4. Insert valve gate assembly into back of tool so the valve gate assembly back plate is properly located.
5. Screw down valve cylinder mounting plate.

Figure 42 shows a complete valve gate assembly.

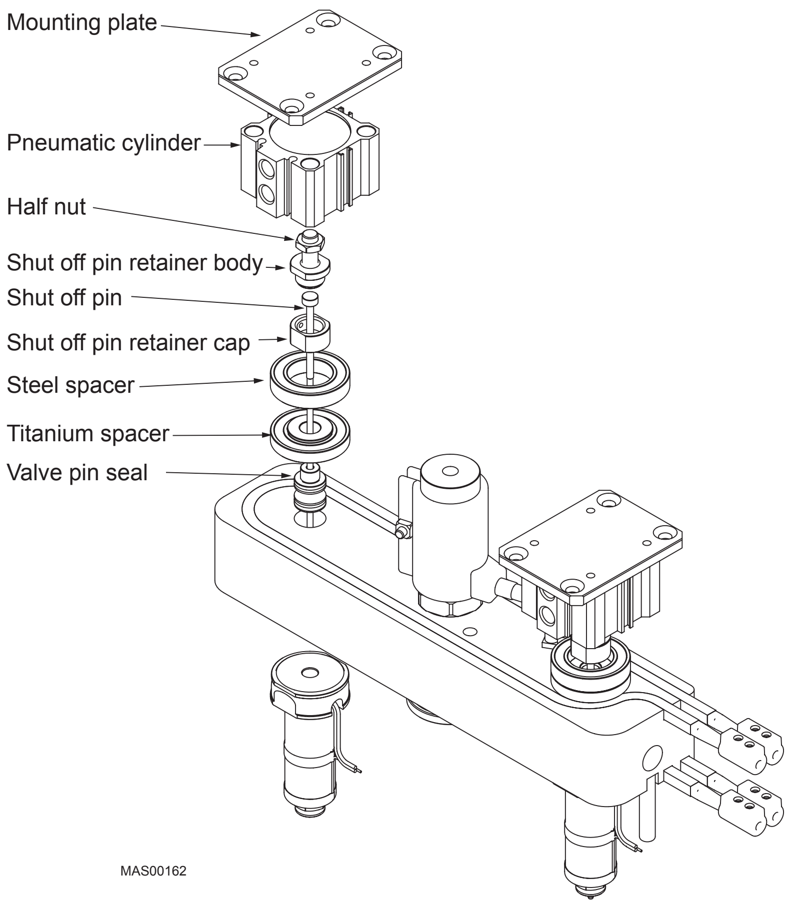

Figure 42: Complete Valve Gate Assembly

Step 5: Check pin length

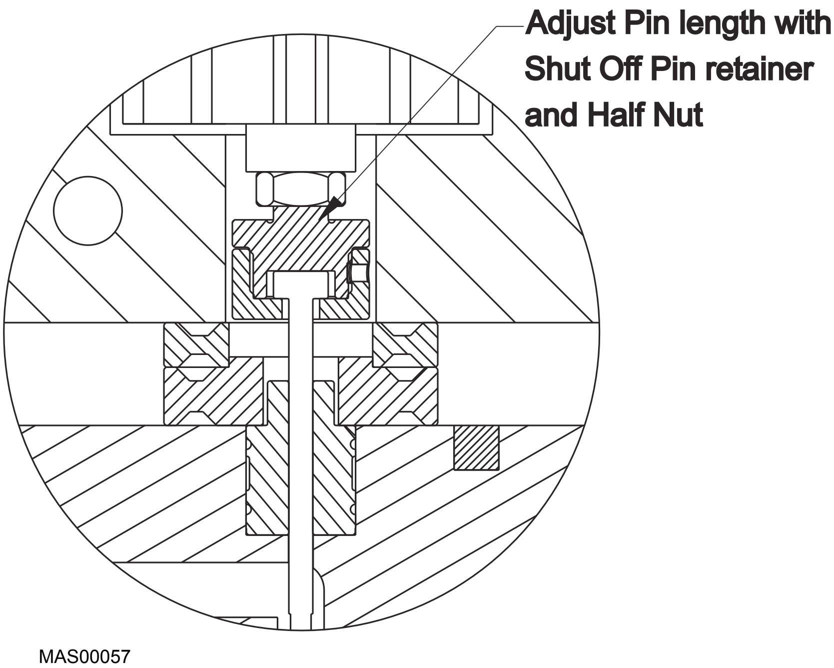

Figure 43: Valve Cylinder Front Face

Apply LOW pressure air to cylinder to bring cylinders forward and then measure the gap at front of gate to the front face of pin (Figure 43) with a depth micrometer. The gap should be equal to the shut off pins E value. If not, remove valve cylinder assembly and adjust pin retainer and half nut until correct.

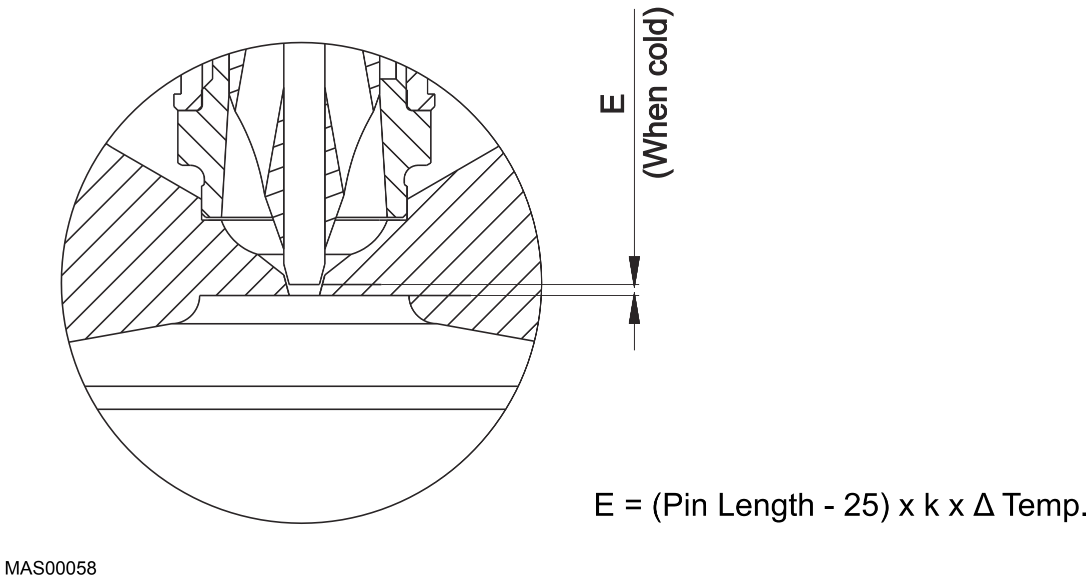

Figure 44: Gap between Gate and Pin

Caution: The gap between the gate and the pin in cold state is critical. If there is too much gap, there will be a poor gate vestige and perhaps drooling from the nozzle. If the gap is too small, the pin can strike the gate and will damage it.

Installing a Manifold

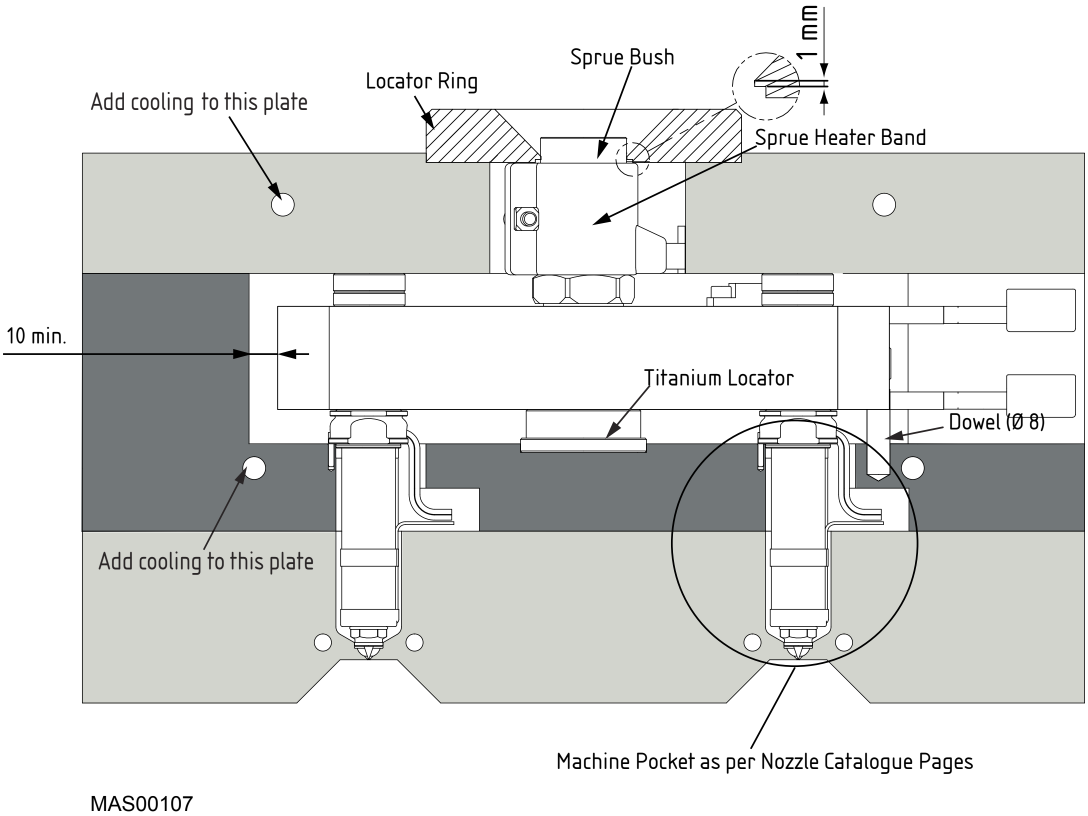

Figure 45: Items to Check on Manifold Installation

- Before assembly, wipe the manifold with a dry, clean cloth.
- Fit the titanium locator and dowel pin and line up manifold between the back plate and the nozzle cavity plate. See Figure 45.

Note: The fixing holes are an assembly aid only; they are not intended to hold the manifold against the nozzle, so replace the spacers. Do not over tighten fixing bolts as this could cause bolt failure when the manifold is heated, and damage the Hot Runner System or the mould.

- Apply bearing blue the top of the nozzle faces. Fit the manifold and check all the nozzles are in full contact with the manifold surface. Carefully remove all bearing blue after the check is completed.
- If applicable, assemble the o-ring to the nozzles.
- If applicable, tighten any ear bolts. To allow for thermal expansion, always use belleview type washers.
- Check clearance between back plate and sprue bush heater. Make sure there is no contact.
- Check that the locator ring of the mould has the correct amount of clearance around top of sprue (0.4 mm).

Starting Hot Runner Systems

Starting or Restarting Nozzles in a Manifold Application

Use the following steps to start or restart a nozzle in a manifold application:

1. Follow the wiring diagram of the system to ensure all cabling (power and thermocouple) are connected to the correct zones.
2. Turn on the manifold zones ONLY and set the temperature to 100°C. The temperature controller must be set on Soft Start mode to dry any moisture absorbed into the elements during transit.
3. Observe that all zones increase in temperature evenly and consistently.
4. Once all zones have reached 100°C, wait 5 minutes for soak and then set to required melt temperatures to + 10°C. (Machine barrels should be set at melt temperature + 5°C.)
5. While waiting for the manifold temperatures to reach set point, purge the machine with the appropriate plastic material in a natural state (preferably one with a lower melt than that to be used to make the parts). The stiffer natural material is used to fill the insulation gaps and is beneficial for faster colour changes. It is less effected by the continuous temperature and therefore reduces the build up of the colour pigments and or resident melt degradation.
6. Check machine settings. (For first startup, all speeds and pressures should be set low to limit any unforeseen damages.)
   - Maximum injection pressure set to 70 MPa (avoid first shots from flashing tool)
   - Injection speed set at 30%
   - Injection volume set at 70% of expected shot weight (if part detail allows)
   - Injection pack pressure to 30 MPa
   - Mould daylight correct set for tool
   - Mould close pressure safety set
   - Slow mould close set
7. Manifold should be approximately at 90% of the set temperature by now (20 minutes) turn on nozzles drop zones
   - The zones can be turned on in banks to more easily monitor rise in temperature
   - A similar method to heating the manifold should be followed with the first heating of the nozzles elements
   - Set to 100°C, controller must be set on soft start. (For drying of any moisture absorbed into the elements during transit)
   - Observe that all zones increase in temperature evenly and consistently.
   - Once all zones have reached 100°C, wait 5 minutes for soak and then set to required melt temp + 10°C (MX series) or + 35°C (MT series).
   - Nozzles will reach set point normally within 5 minutes.
8. Check all zones are at set point and are stable.
9. Purge machine barrel to fresh material.
10. Hunt injection unit slowly to sprue bush.
11. Switch machine to semi automatic and engage cycle.
    - The moulding machine will cycle through hunt, inject, pack, screw, recharge, and then cooling.
    - Depending on the cycle time set, the machine can be stopped at this point opened and the

process repeated.

12. Repeat this process 2 to 3 times before plastic appears at the gate as all the channels where empty. Some moulding machines can manually inject into a manifold and so the filling of the manifold can be more easily observed.

13. Keep a careful eye on the cavities for the first sign of plastic, it will require clearing from the gates and cavity before the next shot is possible.

14. Cycle the machine fully obtaining a 70% shot.

15. Change to the correct material and colour.

16. Tuning of the mould machine to production setting can now begin. Take care with the injection pressures and shot size as you can easily flash the tool causing damage.

Note: Often the nozzle will need to run hotter than barrel temperature to achieve a good result.

If mould is left idle and needs to be restarted, repeat the above procedure.

Note: Do not increase manifold or nozzle temperatures by large amounts as increases of temperature above the design figures can damage the sealing faces of the manifold and nozzle due to excessive expansion.

Starting or Restarting a Nozzle in a Single Nozzle Application

Use the following steps to start or restart a nozzle in a single nozzle application:

1. Ensure “Soft Start” is selected on the temperature controller and the correct operating temperature is set.
2. Allow a minimum of 10 minutes for the nozzle to heat up to operating temperature.
3. Purge machine barrel before connecting to the nozzle.
4. Slowly bring machine nozzle up to the nozzle to avoid damage.
5. When nozzle is at the correct temperature, inject the plastic into the mould.
6. Check material comes out the gate and correct if needed.
7. Adjust nozzle temperature to get suitable moulding.

Note: Often the nozzle will need to run hotter than barrel temperature to achieve a good result.

If the machine is left idle, it is strongly recommended to gently purge the first shot through the nozzle. This will clear any cool slug that may have formed near the head.

For a single cavity heated sprue bush or nozzle, check that the set temperature is reached and the plastic is molten at the head of the nozzle. If the plastic is not completely molten, removed the cold slug from the bushing before injection.

Maintaining a Hot Runner System

Recommended Procedure for Colour Change

1. Make the first shot in the mould in natural material.
2. Increase machine barrel temperatures by 20ºC.
3. Increase mould temperatures by 15ºC by either turning off water or if using a temperature control unit.
4. Increase manifold temperatures by 15 to 20ºC.
5. Increase nozzle temperatures by 25 to 30ºC
6. Retract nozzle and purge machine barrel using a low melt flow (MFI) natural polypropylene until clear.
7. Restart normal cycle with the low MFI polypropylene. **IMPORTANT:** Some components may not be able to be moulded in a low MFI PP. If this is the case try using a mixture of say 50:50 of existing MFI and a low MFI PP.
8. When mouldings are clean, purge machine and entire hot runner system with the natural material that is being used for the production run.
9. When satisfied that natural material moulded parts are OK reduce all temperatures to the required settings and add new colour. Temperatures should be reduced in the reverse order.
10. Proceed with full production run.

Maintaining the Valve Gate System

The Mastip valve gate system should operate trouble free, if you follow a few simple maintenance procedures:

- Keep the pneumatic air clean and free from water or oil.
- Keep the hydraulic fluid properly filtered and changed regularly.
- Maintain a minimum air pressure at cylinder of 6 bar.
- Maintain a maximum hydraulic pressure of 50 bar.
- Break down tool and inspect it every six to twelve months depending on use. Check the following for wear and possible leaks, and service and replace, if required:
    - cylinders
    - valve pins
    - valve pin seal

Replacing Manifold Screwed-In Heaters and Thermocouples

If the manifold is supplied with replacement heaters, store them in a warm, dry place.

To replace a heater, use the following steps:

1. Let the tool cool down.
2. Disassemble the fixed side of the mould.
3. Remove manifold from mould, if necessary.
4. Undo the fixing screws holding the heater. Remove heater or thermocouple.

5. After you removed the heaters, inspect and clean groove.
6. Use a soft hammer to install the new heater in the groove. Start at the centre of the element and work towards the ends. Do not use excessive force. When installing new heater, do not bend or distort the element as this will damage the internal heating element.
7. Test heater insulation.
8. Reassemble fixed side of mould.
9. Use the "Soft Start" setting to start the new manifold heaters.

Contact your local Mastip representative for additional replacement heaters or thermocouples. Have the manifold's approval drawing or the engraved number on the manifold ready for reordering.

Replacing Manifold Pressed-In Heaters

Removing Pressed-In Heaters

1. Remove manifold from the mould.
2. Ensure the heater face of the manifold is clean and free from any materials that might restrict its removal from the heater slot.
3. Bend the heater ends up out of the slot

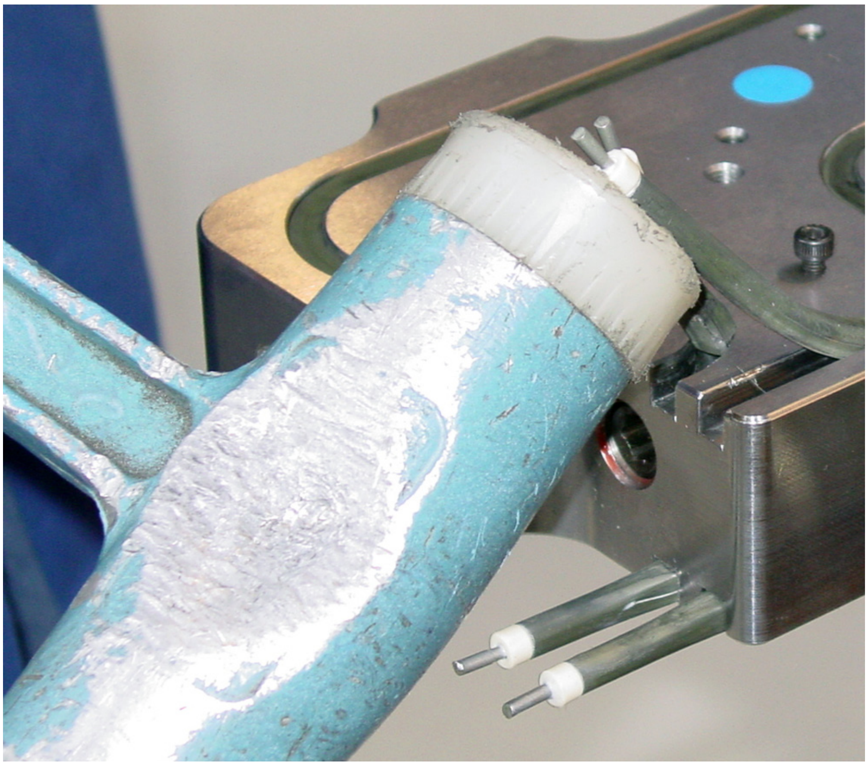

Figure 46: Using a Hammer to Bend Up the Ends of a Pressed-in Heater

4. Using a hammer and a plastic wedge between the heater and the bottom of the slot, pry the heater out of the slot, working from the ends of the heater towards the centre. To remove curved heater sections, use the plastic wedge and a hammer. To remove straight heater sections, pull on the heater ends and bend it out of the heater slot.

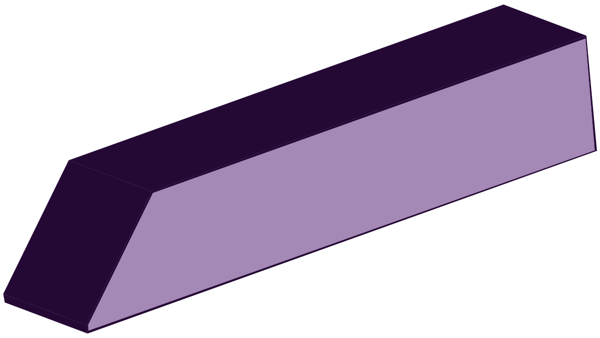

Figure 47: Plastic Wedge

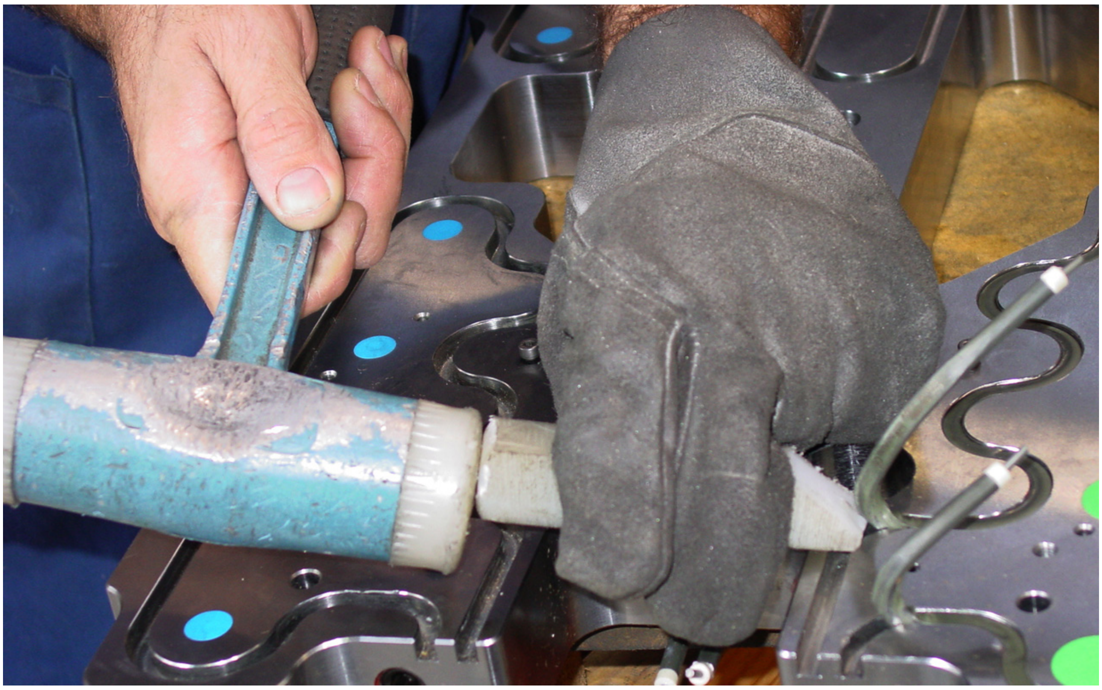

Figure 48: Use a Plastic Wedge to Remove Pressed-in Heaters Around Curves

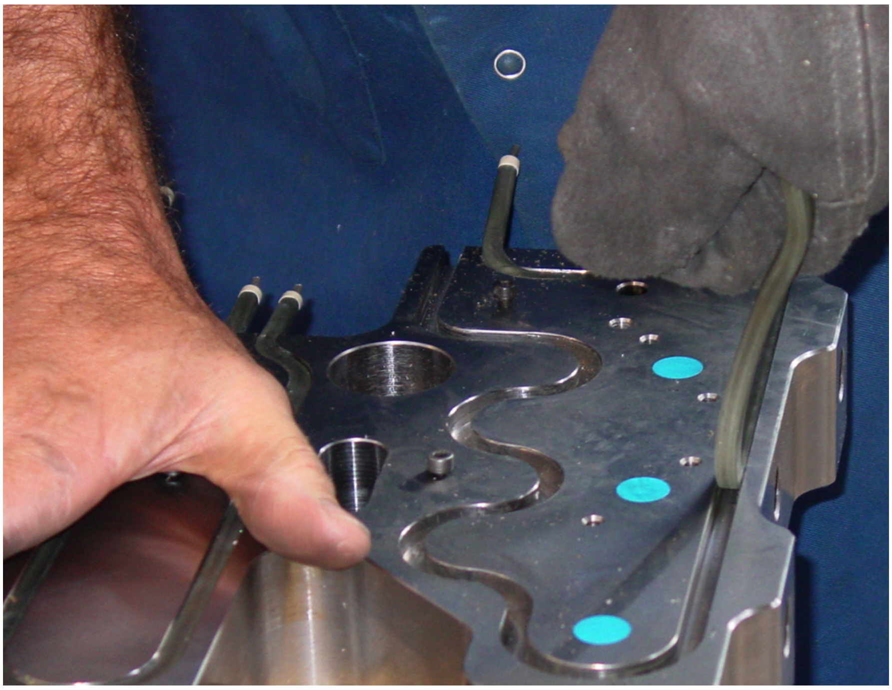

Figure 49: Pull Pressed-in Heaters out of Straight Sections

5. Dispose of the removed heaters.

Inserting Pressed-In Heaters

1. Ensure the manifold heater face and slot are clean and free from any materials which may restrict its fitment.
2. Ensure the heater slot does not have any burrs or sharp edges which may damage the heater during fitting.
3. Place the manifold on a solid surface with the heater slot facing upwards.
4. Lay the new pre-bent heater on top of the manifold heater slot.
5. Starting at the centre of the heater and working towards the heater ends, use a soft-faced hammer to lightly tap the heater into the slot until the heater is sitting just below the manifold.

Figure 50: Hammering in a Pressed-in Heater

6. Starting at the centre of the heater and working towards the heater ends, use a plastic wedge and hammer to tap the heater onto the bottom of the heater slot.

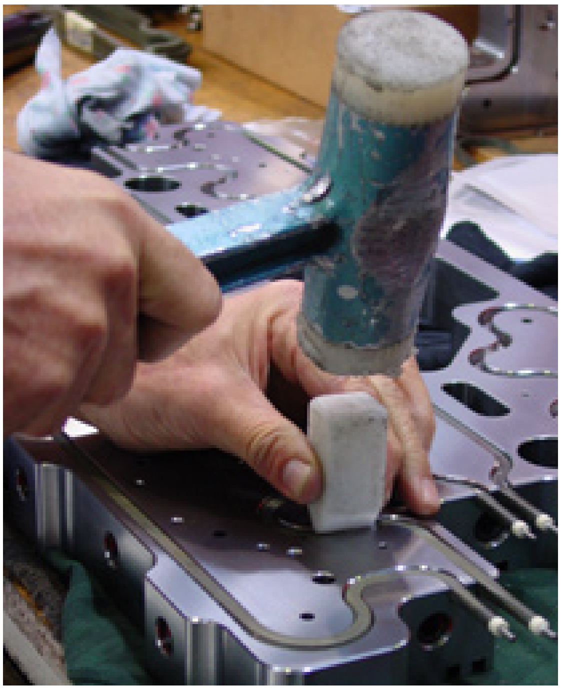

Figure 51: Using a Plastic Wedge to Hammer the Heater onto the Bottom of the Heater Slot

7. Using a hammer and a soft aluminium or brass tool (see below) gently tap the heater top until it is approximately 1 mm below the manifold face. Repeat this action working along towards the heater ends until the heater has been pressed in.

Figure 52: Using a Soft Brass Tool to Finish Heater Installation and Close Up of Tool

Gently tapping with a soft aluminium tool and hammer slightly indents the heater face, giving it a tight fit in the heater slot. The heater top should be slightly indented as shown in Figure 53.

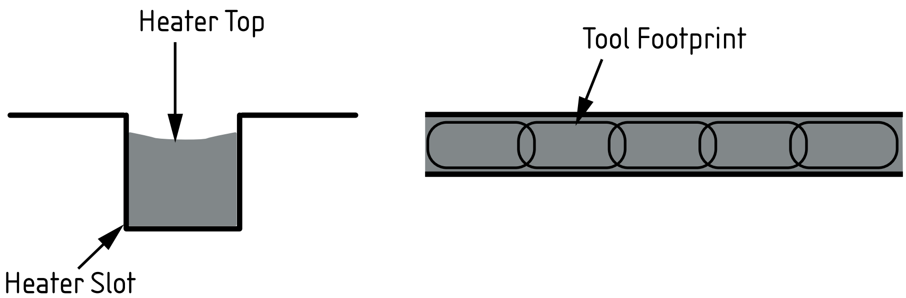

Figure 53: Pressed-in Heater Top after Correct Installation

8. Perform insulation and resistance tests on the heater, and visually check to ensure heater has been assembled correctly.

9. Assemble the manifold into mould.

Note: Using excessive force on the heater may destroy the heater.

Cleaning the Manifold Runners

Caution: If the manifold contains deviation plugs, use a fluidised bath to clean channels.

Disassembling the Manifold Runners

1. Let the tool cool down
2. Disassemble the fixed side of the mould. Do not bow or distort manifold or the mould plates.
3. Remove the manifold from the mould plates.
4. Locate and remove the End Plug M4 location grub screws from the top or bottom faces. (You may have to remove the heater if screws are located at bottom of heater groove). (You may need to reheat the manifold to loosen the screws and plugs).
5. Remove the End Plug locking screw from behind the End Plug.
6. **Note:** Remove the End Plug using a slide hammer attached to the M6 thread in back of End Plug.
7. Remove plastic from runners.
8. Heat the manifold to the lower range of its processing temperature and remove the plastic using a hot wire with a hook on the end to hook out the melt just as the outer layer of plastic melts in the runner. Take extreme care not to scratch bores.

   If this is not successful, heat the manifold to full operating temperature and allow to soak for 20-30 minutes and use a tight fitting rod of soft material (for example, aluminium) to push out the plastic from the runners.

Caution: Do not under any circumstances attempt to blow out hot plastic with an air gun.

Reassemble manifold and mould in the reverse order as specified in the Disassemble the Manifold Runners section above.

Reassembling the Manifold

Apply high temperature anti-seize compound to all threads upon re-assembly.

Carefully refit end plugs, locking and locating screws, making sure alignment of end radii is correct.

Servicing Nozzles

Parts of the BX Nozzle

The BX nozzle is designed for manifolds. The dowel pin, tip, thermocouple, nut and snap ring can be used on a MX or SX nozzle of the same series. The heater, heater cover, T/C clip and heater cap can be used on an SX nozzle of the same series.

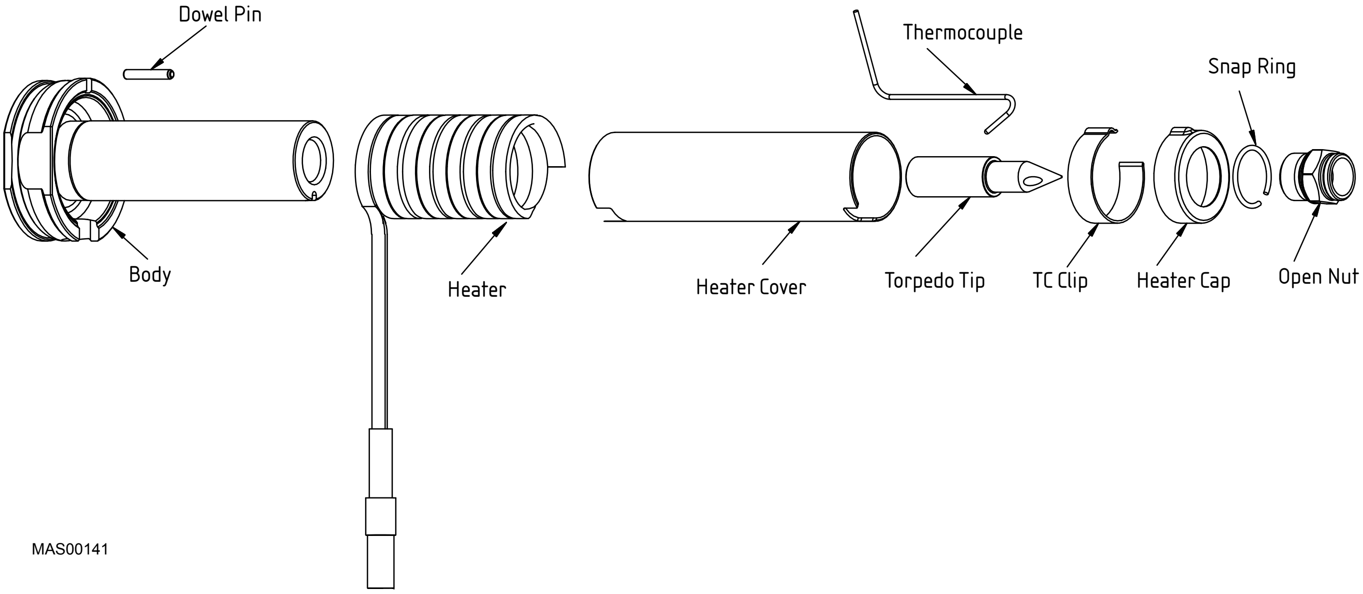

Figure 54: Parts of a BX Nozzle

Parts of the MX Nozzle

The MX nozzle can be used in a Hot Half or standard manifold. If the nozzle is configured for a Hot Half, you need to only remove the snap ring and heater cap to access the thermocouple and heater.

The dowel pin, tip, thermocouple, nut, and snap ring can be used on a BX or SX nozzle of the same series.

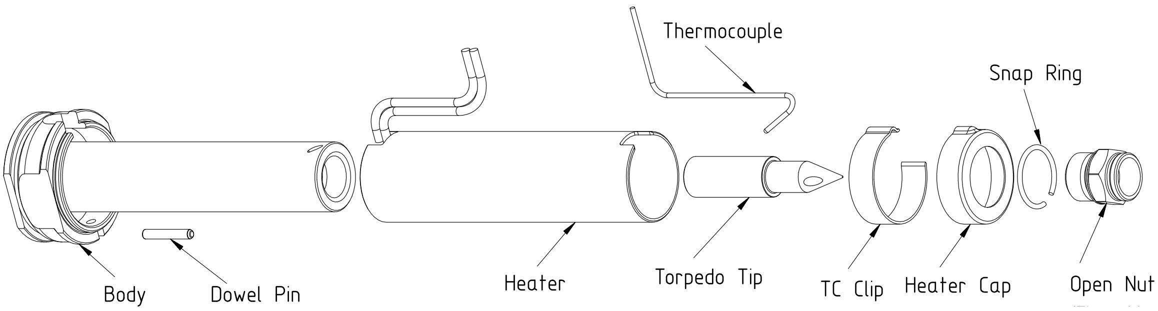

Figure 55: Parts of a MX Nozzle

Parts of the SX Nozzle

The SX nozzle is designed for single nozzle applications. The dowel pin, tip, thermocouple, nut and snap ring can be used on a MX or BX nozzle of the same series. The heater, heater cover, T/C clip and heater cap can be used on a BX nozzle of the same series.

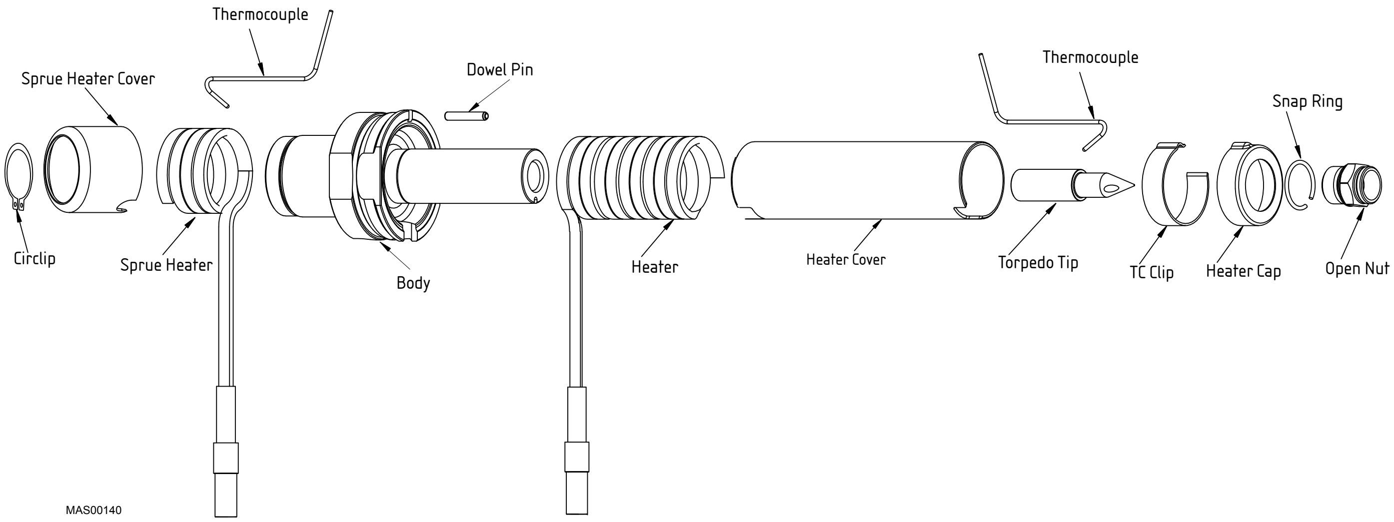

Figure 56: Parts of an SX Nozzle

Replacing a Snap Ring on an X Range Nozzle

The snap ring is designed to fasten the heater cap in place during the operation of the nozzle. If the snap ring is not installed correctly the heater cap may become loose during operation of the nozzle causing incorrect readings of the thermocouple, poor performance of the nozzle, and possible failure of the heater.

Step 1: Locate the ends of the snap ring.

Step 2: Use a strong thin tool (such as a blade) to wedge between the end of the snap ring and the heater cap.

Figure 57: Wedge a blade under a X Range Nozzle Snap Ring

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Step 3: Twist the end of the tool towards the end of the nut so that the end of the snap ring rides up out of the groove and over the nut shoulder. Step 4: Slowly slide the tool around the snap ring, moving the rest of the snap ring out of the groove and over the nut shoulder.	 Figure 58: Remove an X Range Snap Ring
Step 5: Sit the snap ring on the top of the nut. Step 6: Holding one of the ends of the snap ring over the side of the nut towards the heater cap, slowly push the snap ring around the side of the nut shoulder and into the groove. The snap ring should "click" or snap into the groove. If the snap ring is not sitting securely into the groove in the nut it may need to be pushed in slightly with a soft dolly.	 Figure 59: Example of Snap Ring on an X nozzle

Replacing a Tip from an X Range Nozzle

If the MX nozzle is loaded in a hot half, you do not need to remove the nozzle from the Nozzle Cavity Plate. Otherwise, dismantle the hot runner system to service the nozzle to reach the nozzle.

Step 1: Heat nozzle to melt temperature to ease disassembly.

Step 2: Unscrew the nut with a ring spanner.

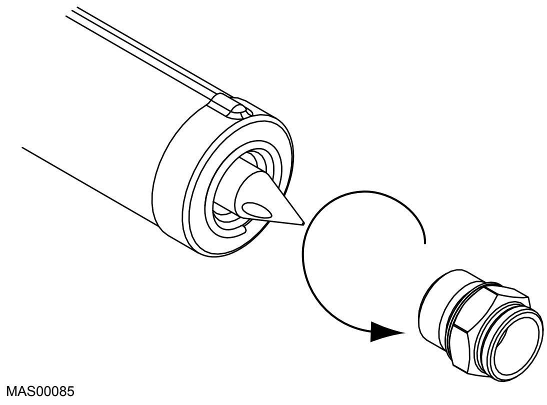


Figure 60: Unscrew Nut on an X Range Nozzle

Step 3: Remove the snap ring (it should fall off after the nut is removed).

Step 4: Remove plastic from nut and tip, taking care not to scratch or damage either.

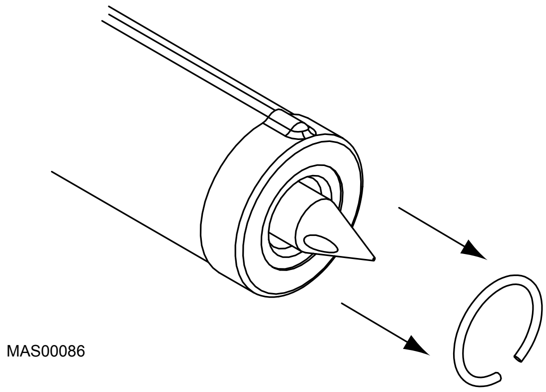


Figure 61: Remove Snap Ring on an X Range Nozzle

Step 5: Remove the tip from the assembly.

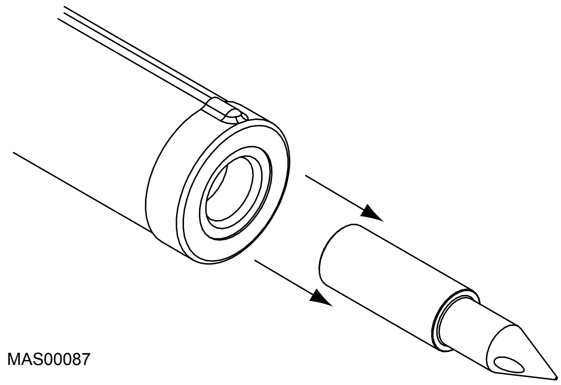


Figure 62: Remove Tip on an X Range Nozzle

Step 6: Ensure hole in body is clear of any plastic or obstructions and gently slide the tip into the assembly.

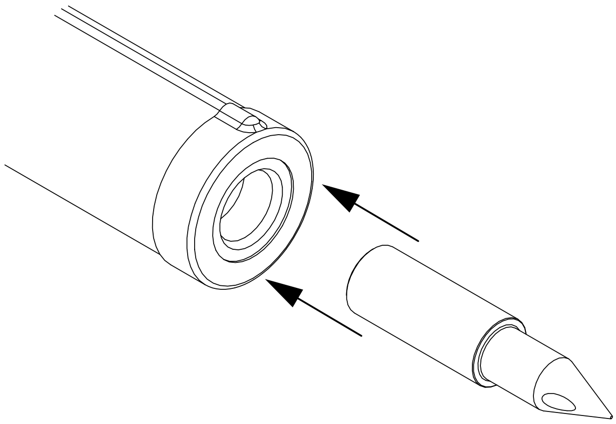


Figure 63: Insert Tip in an X Range Nozzle

Step 7: Place snap ring over the tip and screw down the nut. The snap ring should "snap" into place around the nut. See the X Range Nozzles Torque Setting table for the correct torque for the nut.

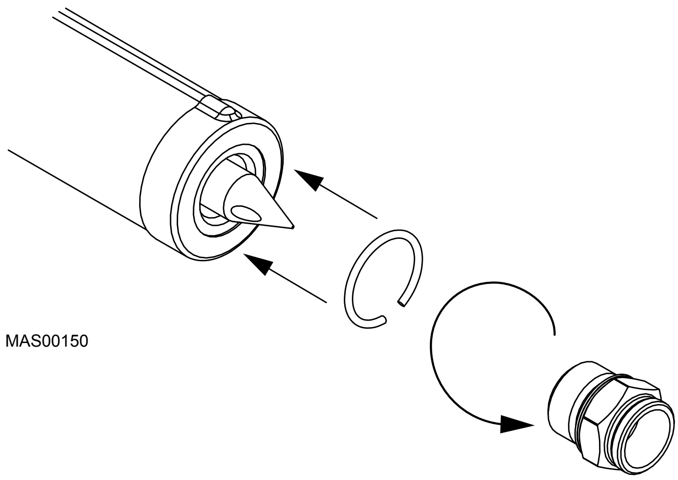


Figure 64: Replace Snap Ring and Nut on an X Range Nozzle

X Range Nozzles Torque Settings

X Range Series	Lb. feet	N.m
13	10	15
16	15	20
19	20	25

Replacing the Thermocouple on an X Range Nozzle

If the BX or MX nozzle is in a rear-loading configuration, you must dismantle the hot runner system to service the nozzle and then re-assemble the system. You must remove the SX nozzle from the mould. If the MX nozzle is in a Hot Half, you only need to remove the Cavity plate to access the nozzle tip to replace the thermocouple.

Follow these steps to replace a thermocouple from an X Range nozzle:

Step 1: Remove the snap ring (see the procedure in the Replacing the Snap Ring section), the heater cap, and the T/C clip, in that order.

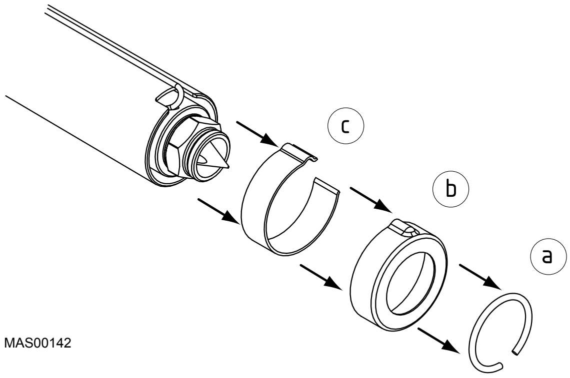


Figure 65: Remove T/C Clip, Heater Cap, and Snap Ring from an X Range Nozzle

Step 2: Gently remove the thermocouple from the thermocouple hole in the nozzle.

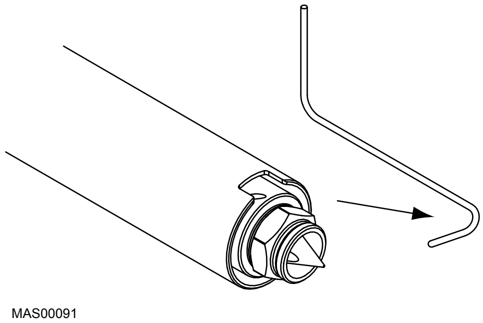


Figure 66: Remove Thermocouple from an X Range Nozzle

Step 3: Insert the new thermocouple into the thermocouple hole in the nozzle.

Step 4: Gently bend the thermocouple around and over the top of the heater cover. Use a smooth continuous bend radius; do not sharply kink the thermocouple.

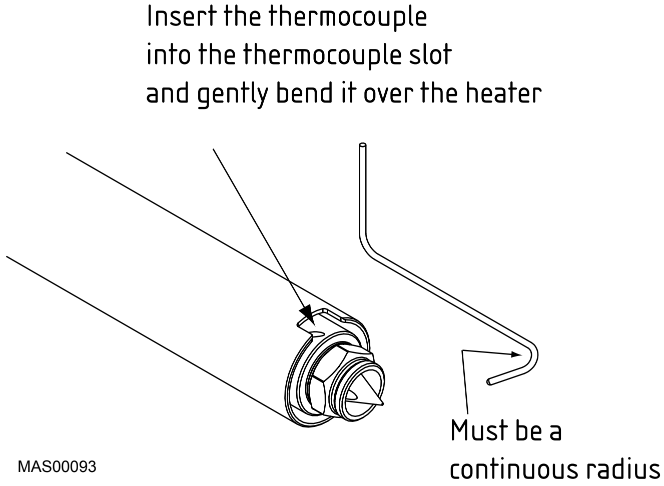


Figure 67: Install Thermocouple on an X Range Nozzle

Step 5: Slip on the T/C Clip (a). Insert the heater cap onto the top of the heater, taking care to align the groove in the cap with the thermocouple (b). Re-install the snap ring (c).

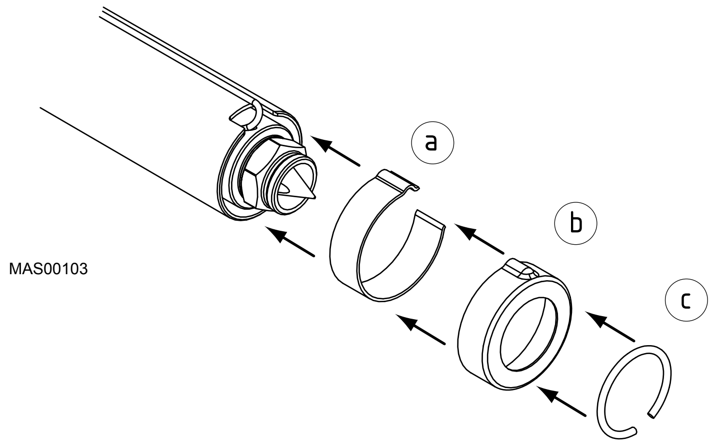


Figure 68: Install T/C Clip, Heater Cap, and Snap Ring on an X Range Nozzle

Replacing the Heater on an MX Nozzle in a Hot Half

To replace the heater on an MX nozzle in a Hot Half, do not remove the nozzle from the mould.

Step 1: Remove the snap ring, heater cap, and T/C clip, in that order.

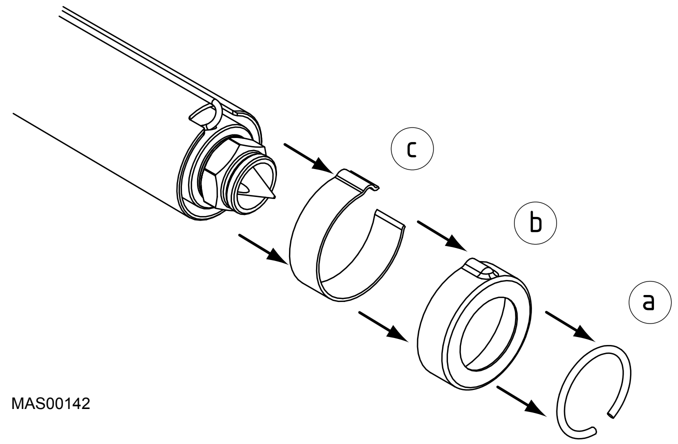


Figure 69: Remove T/C Clip, Heater Cap, and Snap Ring from an MX Nozzle

Step 2: Remove the thermocouple.

The nut and tip remain secure in the nozzle.

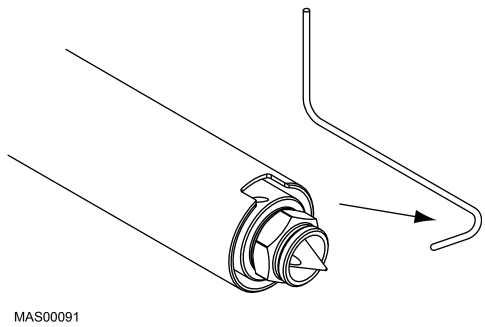


Figure 70: Remove Thermocouple from an MX Nozzle

Step 3: Using a twisting motion pull the heater and cover from the nozzle, taking care not to knock the end of the tip or to damage the heater wires.

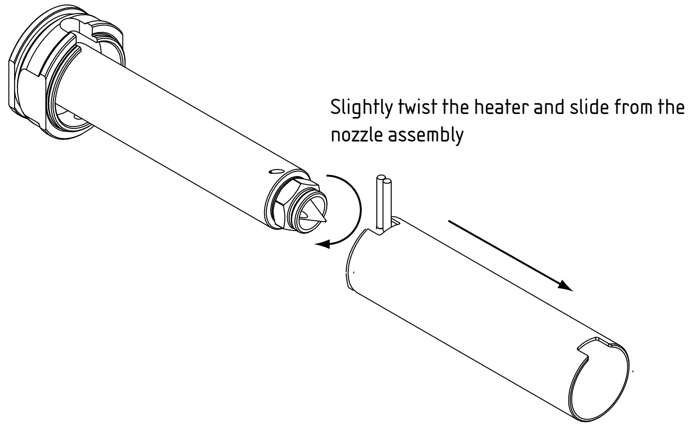


Figure 71: Remove Heater from an MX nozzle

Step 4: Clean any residue from the heater surface on the nozzle body.

Step 5: Slide on the new heater and cover, taking care not to knock the end of the tip or to damage the heater wires. Check the heater resistance.

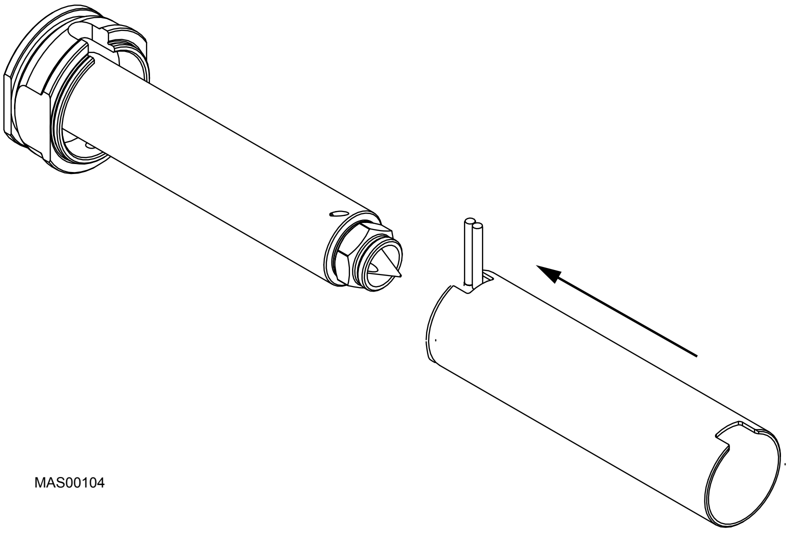


Figure 72: Slide Heater on MX Nozzle

Step 6: Insert the thermocouple into the thermocouple hole in the nozzle.

Step 7: Gently bend the thermocouple around and over the top of the heater cover. Use a smooth continuous bend radius; do not sharply kink the thermocouple.

Step 8: Check the resistance of the thermocouple with a multi meter. The resistance should be 10 ohms (or less).

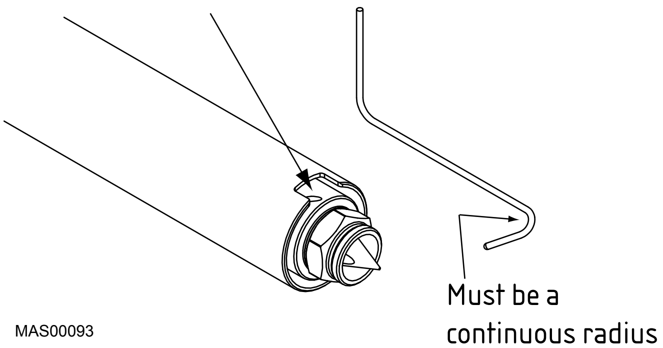


Figure 73: Install Thermocouple on MX Nozzle

Step 8: Reassemble the T/C clip (a), the heater cap (b), and the snap ring (c) - in that order.

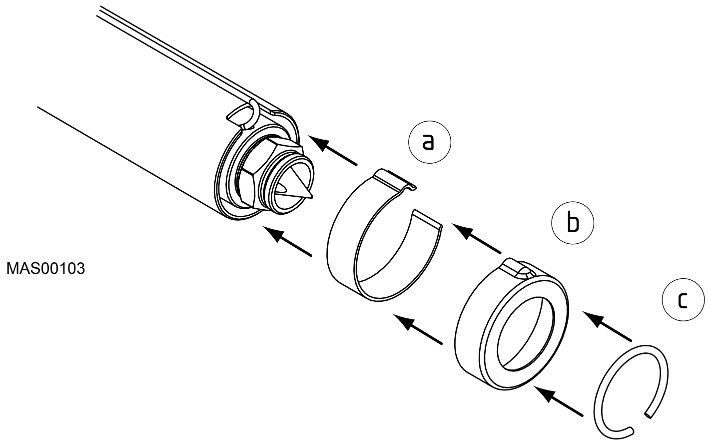
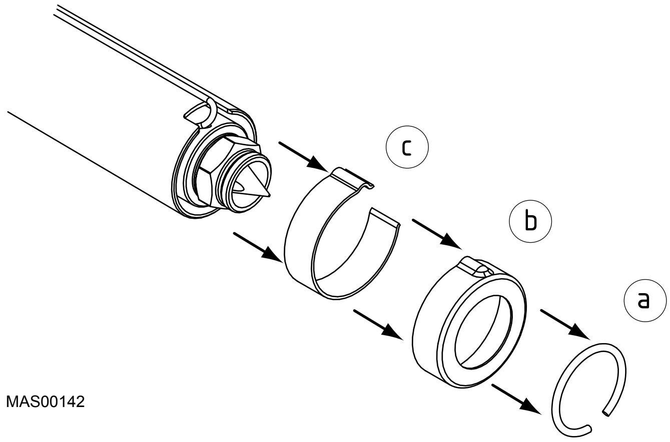
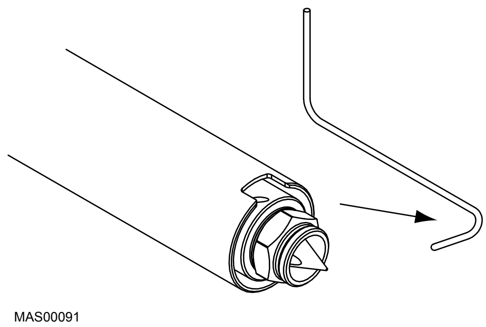


Figure 74: Re-install T/C Clip, Heater Cap, and Snap Ring on an MX Nozzle

Replacing a Heater and Thermocouple on a BX or SX Nozzle

To replace the heater or thermocouple, you must remove the nozzle from the mould.

Step 1: Remove the snap ring, the heater cap, the T/C clip, and the thermocouple - in that order.	 **Figure 75: Remove Snap Ring, Heater Cap, and T/C Clip from a BX or SX Nozzle**
Step 2: Remove the thermocouple.	 **Figure 76: Remove Thermocouple from a BX or SX Nozzle**

Step 3: Slide off the heater cover (leave the tip and the nut in the nozzle).

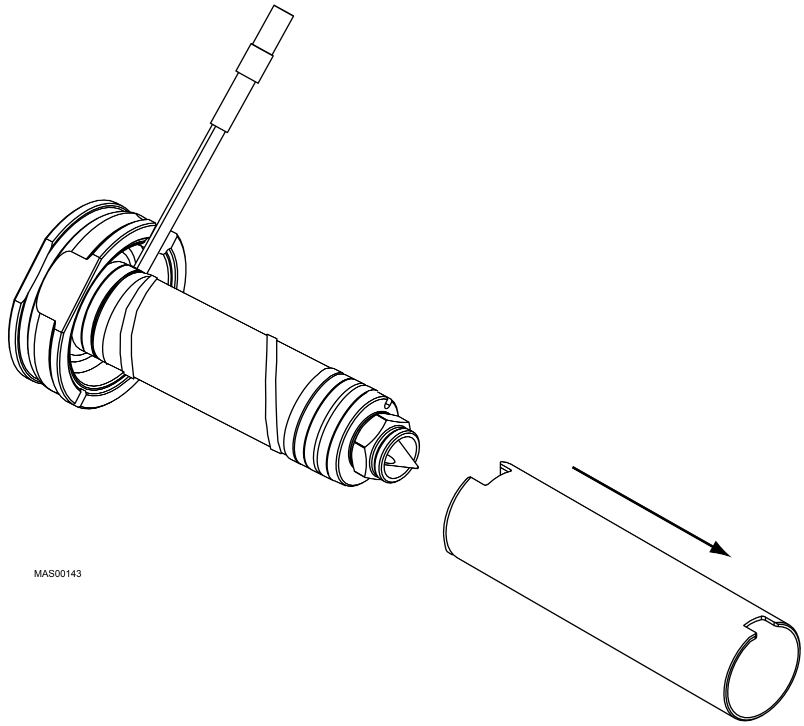


Figure 77: Slide off BX or SX Nozzle Heater Cover

Step 4: Grip the nozzle head and remove the coil heater by turning the tip end of the heater in a clockwise direction to "unwind" or loosen the heater coils, and at the same time pull the heater off the body. (A tool to push against the heater is available from Mastip.)

Step 5: To replace heater, push heater as far as it will go onto the nozzle body, with bottom heater connection in line with slot on body. Turn the tip end of the heater in a clockwise direction to "unwind" or loosen the heater coils as you continue to push the heater towards the head of the nozzle. Make sure heater is fully forward on body.

Step 6: Check the resistance of the new heater.

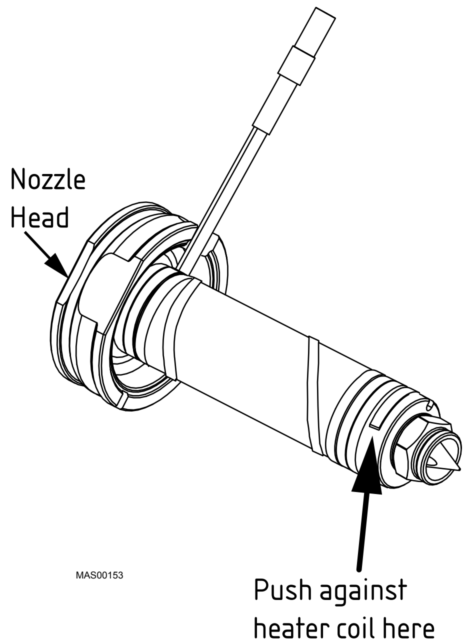


Figure 78: Remove BX or SX Heater

Step 7: Slide on the heater cover. (The bigger notch is for the heater wire and the smaller notch is for the thermocouple.) If the cover is tight check that the heater is not partially unwound.

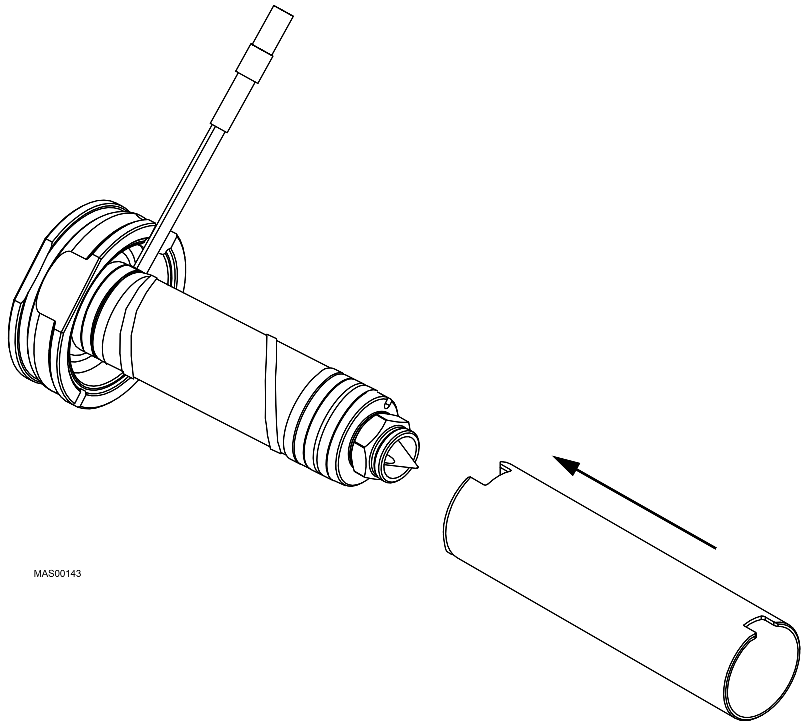


Figure 79: Slide on BX or SX Heater Cover

Step 8: When replacing the thermocouple you need to bend the end. The T/C bend radius is 3 mm.

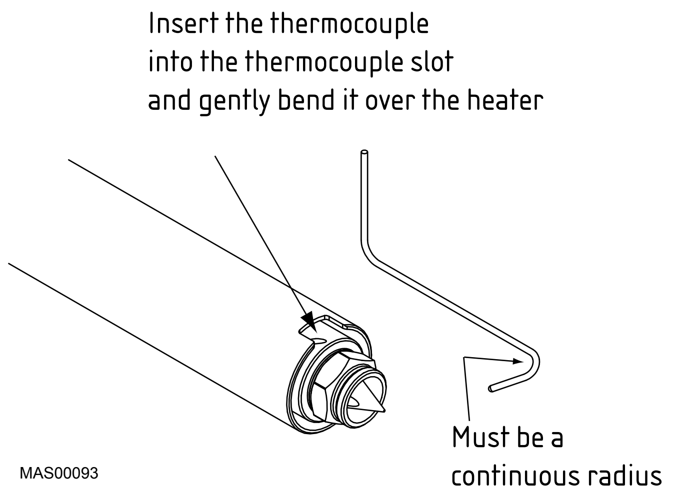


Figure 80: Replace BX or SX Thermocouple

Step 9: Refit the T/C Clip, the heater cap and the snap ring.

Step 10: Check the resistance of the thermocouple with a multi meter, the resistance should be 10 ohms (or less).

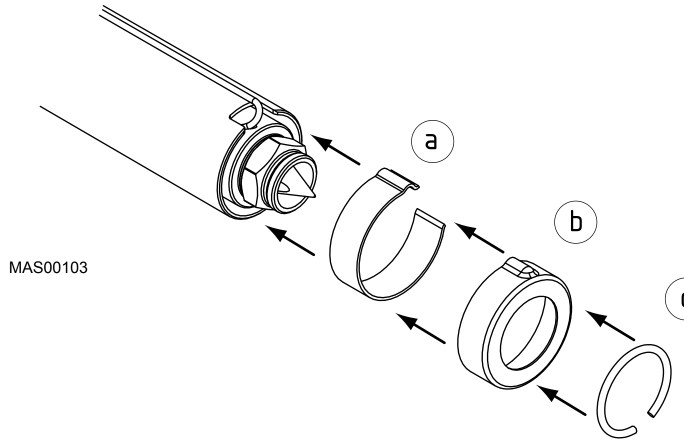


Figure 81: Replace BX or SX T/C Clip, Heater Cap, and Snap Ring

Replacing the SX Sprue Heater and/or Sprue Thermocouple

You must remove the SX nozzle from the system to replace the sprue heater and/or sprue thermocouple.

Step 1: Remove the circlip.

Step 2: Slide off the sprue heater cover.

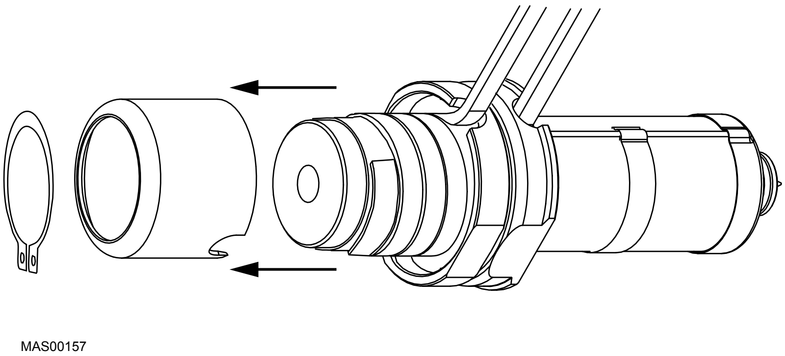


Figure 82: Remove the SX Circlip and Sprue Heater Cover

Step 3: Grip the nozzle head and remove the coil heater by turning the tip end of the heater in a clockwise direction to “unwind” or loosen the heater coils, and at the same time pull the heater off the body.

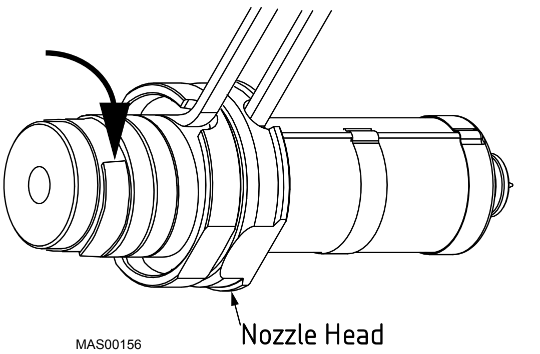


Figure 83: Remove SX Sprue Heater

Step 4: Replace the sprue thermocouple, if necessary. If not, hold the thermocouple or it will fall out of the nozzle. (If you replaced the thermocouple, check the resistance of the new thermocouple. The resistance should be 10 ohms or less.)

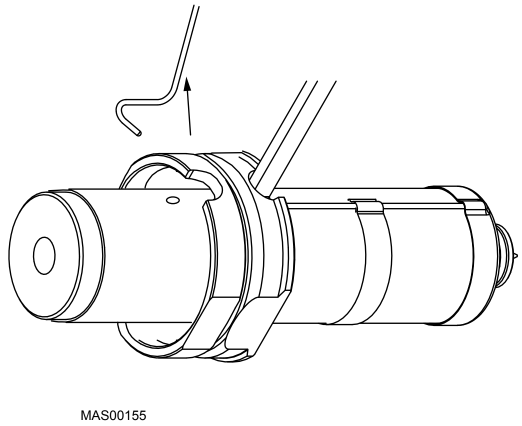


Figure 84: Replace SX Sprue Thermocouple

Step 5: To replace heater, push heater as far as it will go onto the nozzle body, with bottom heater connection in line with slot on body. Turn the tip end of the heater in a clockwise direction to “unwind” or loosen the heater coils as you continue to push the heater towards the head of the nozzle. Make sure the heater is fully forward on body.

Step 6: Check the resistance on the new heater.

Step 7: Slide on the sprue heater cover.

Step 8: Refit the circlip.

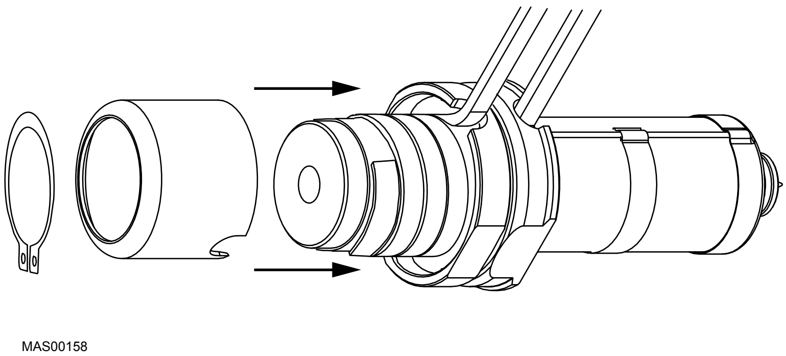


Figure 85: Replace SX Sprue Heater Cover and Circlip

Removing Heater from an MT Range Nozzle

To replace the heater or thermocouple, you must remove the MT nozzle from the mould.

1. Remove the circlip and heater cover.
2. Grip the nozzle head and removed the heater by turning the tip end of the heater in a clockwise direction to “unwind” or loosen the heater coils, and at the same time, pull the heater off the body.
3. Remove the thermocouple.
4. Check the resistance of the thermocouple with a multi meter. The resistance should be 10 ohms (or less).
5. Replace the thermocouple. When replacing the thermocouple, you must bend the end. See Figure 86.
6. To replace the heater, push the heater as far as it will go onto the nozzle body, with the bottom of the heater connection in line with the slot on the body. Turn the tip end of the heater in a clockwise direction to “unwind” or loosen the heater coils as you continue to push the heater towards the end of nozzle. Make sure that the heater is fully forward on the body. See Figure 86.
7. Replace the heater cover. If the heater cover is tight, check that the heater is not partially

unwound.

8. Refit the circlip.
9. Recheck the thermocouple resistance as per step 4.

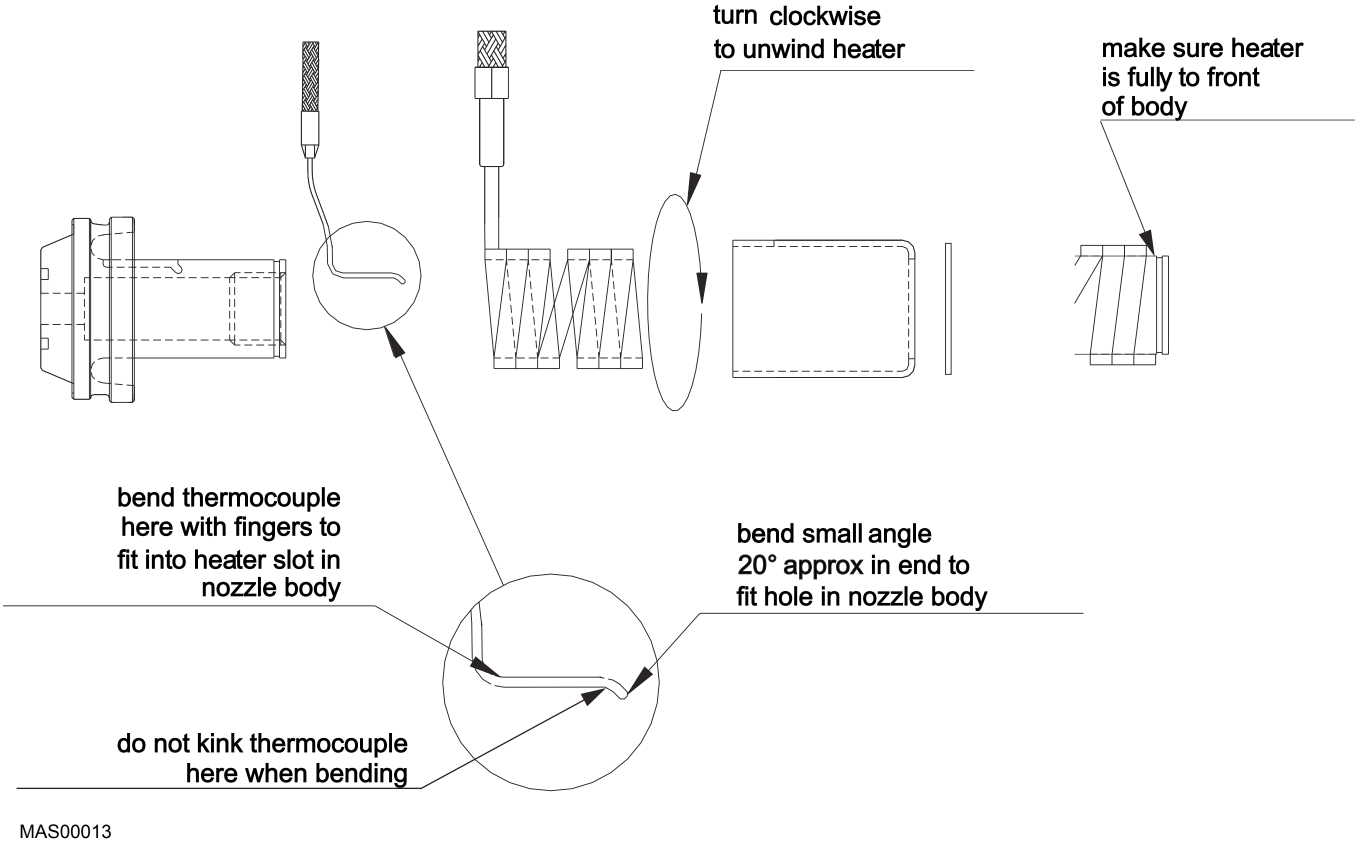


Figure 86: MT Nozzle Thermocouple and Heater Replacement

Removing a Tip from an MT Range Nozzle

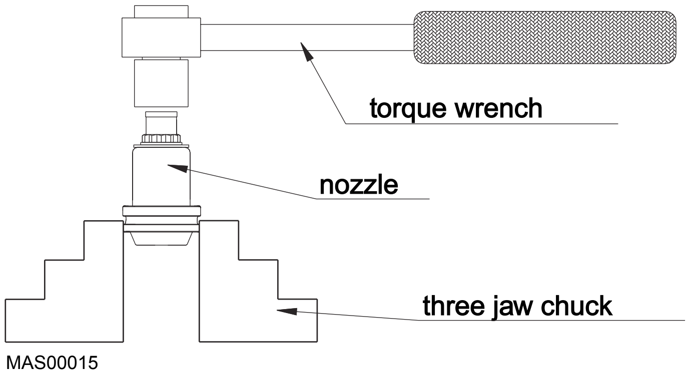


Figure 87: Correct Placement of a Nozzle in a Three Jaw Chuck

1. Remove the nozzle from the manifold.
2. Place the nozzle in a three jaw chuck gripping it by the nozzle head.
3. Heat the nozzle up to the plastics processing temperature. If the tip is full carbide, increase the

temperature to fully expand the body steel off the carbide.

4. Unscrew nut with a ring spanner.
5. Remove plastic from the nut and tip taking care not to scratch or damage either one.
6. If the nozzle is warm, you should be able to extract the tip. Otherwise, measure a soft metal bar and make its diameter 0.5 mm smaller than the dropper hole in the nozzle head and gently tap tip out.
7. Free the tip by inserting the soft metal bar or wooden dowel through the nozzle exit hole from the nozzle head and gently pushing the tip, taking care not to damage the end or internals of the tip.
8. Once the tip is loose, reposition the nozzle so it is lying horizontal to prevent the tip from falling out and becoming damaged (blunt).
9. Continue pushing the tip out with the dowel.

To reassemble the nozzle, use the steps above in reverse. Use the correct torque setting when tightening the nut.

MT Range Nozzles Torque Settings

MT Nozzle Series	Lb. feet	N.m
10	10	15
13	10	15
16	15	15
19	20	25
22	20	25
27	30	40
33	30	40

Replacing a MSM Tip

Use the following steps to install a MSM tip in a Mastip nozzle.

Step 1: Hold the nozzle assembly firmly in a three-jaw chuck with soft jaws.

Step 2: Unscrew the nut, using a special open-end spanner.

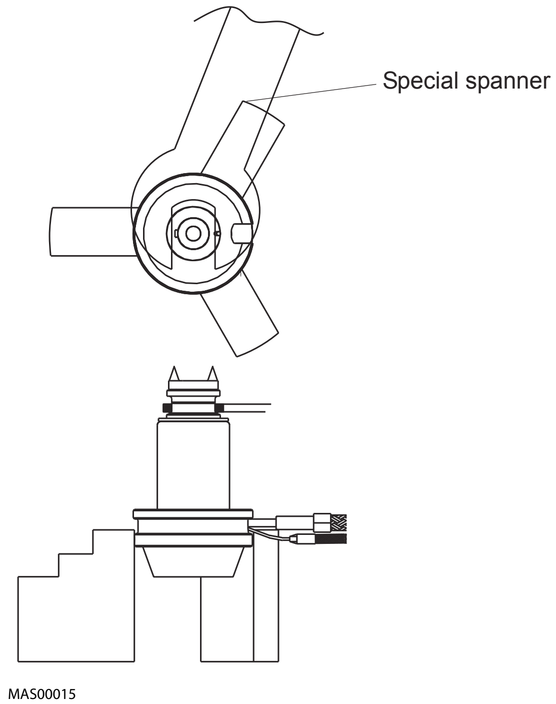


Figure 88: Unscrew MSM Tip

Step 3: Remove the tip from the nozzle.

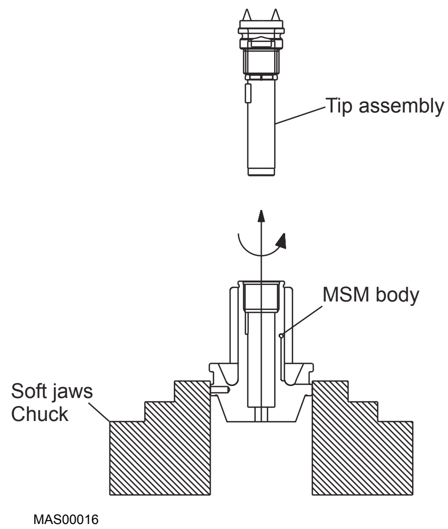


Figure 89: Disassemble MSM Tip

Step 4: Firmly hold the tip assembly with a three jaw chuck with soft jaws.

Step 5: Remove the key from the tip assembly.

Step 6: Carefully remove the collet halves from the tip assembly and remove the MSM nut.

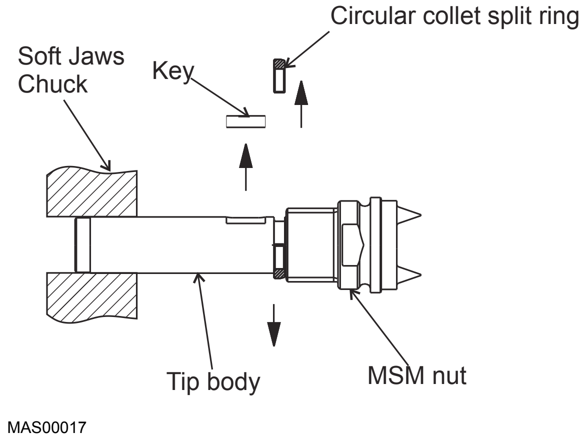


Figure 90: Remove MSM Key and Collet Halves

Step 7: Replace the tip with a new MSM tip.
Step 8: Assemble the unit in reverse order. Align the key to the nozzle body.

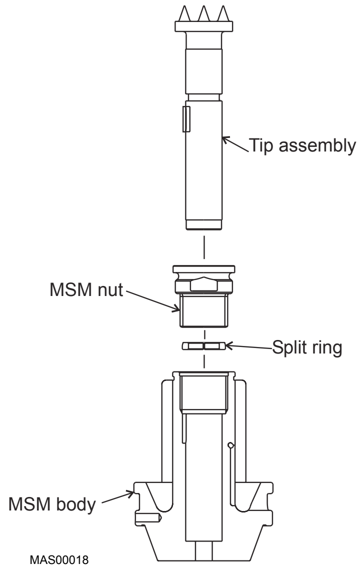


Figure 91: Reassemble MSM Nozzle

Troubleshooting

Troubleshooting Nozzles

Heat Build Up in Bush or Sprue nuts

Cause: In some bush and sprue nut applications, plastic may stick to the front face of the nut during operation. This is due to excessive heat build up in the nut because of inadequate gate cooling or a rapid cycle time.

Remedy: This problem can be corrected by using the Full Contact Bush nuts or a Sprue nut which have a greater contact area with the mould. The contact area can be adjusted to control the heat loss from the nut by machining a small recess into the nut similar to the standard bush or sprue nuts. (See Figure 45)

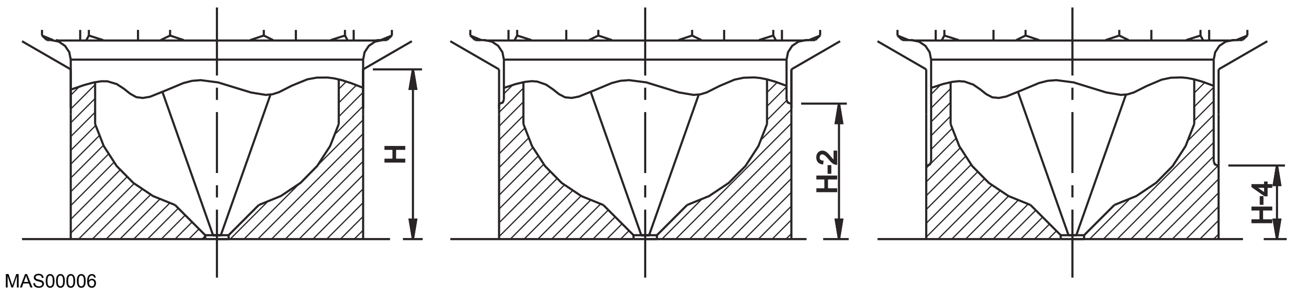


Figure 92: Example of Heat Build Up in Sprue or Bush Nuts

Blocked Nozzle or Gate

Cause: During moulding, a nozzle or gate may become blocked with foreign matter, such as contaminated plastic melt.

Remedy: Do not use a tool, pin, or gas flame to clear the obstacle through the gate.

- To clear a contaminated nozzle, Mastip recommends removing the nozzle from the mould and heating to the plastic materials operating temperature to remove the melt and contaminants.
- Where the blockage is in the gate, Mastip recommends removing the nozzle from the mould and using a hot probe to clear any plastic and contaminants from the gate.

To prevent contaminated material from entering the nozzle, Mastip recommends:

- Using virgin material where ever possible for moulding applications.
- Storing the material in a clean and dry environment.
- Using hopper magnets.
- Using filtered injection machine nozzles.
- Using filtered manifold sprue bush.

Caution: Do not under any circumstances attempt to blow out hot plastic with an air gun.

Part not filling

Cause:

- Melt temperature too low
- Injection pressure too low
- Gate too small or restricted by the tip placed too far forward (See Figure 93) in the nozzle cavity

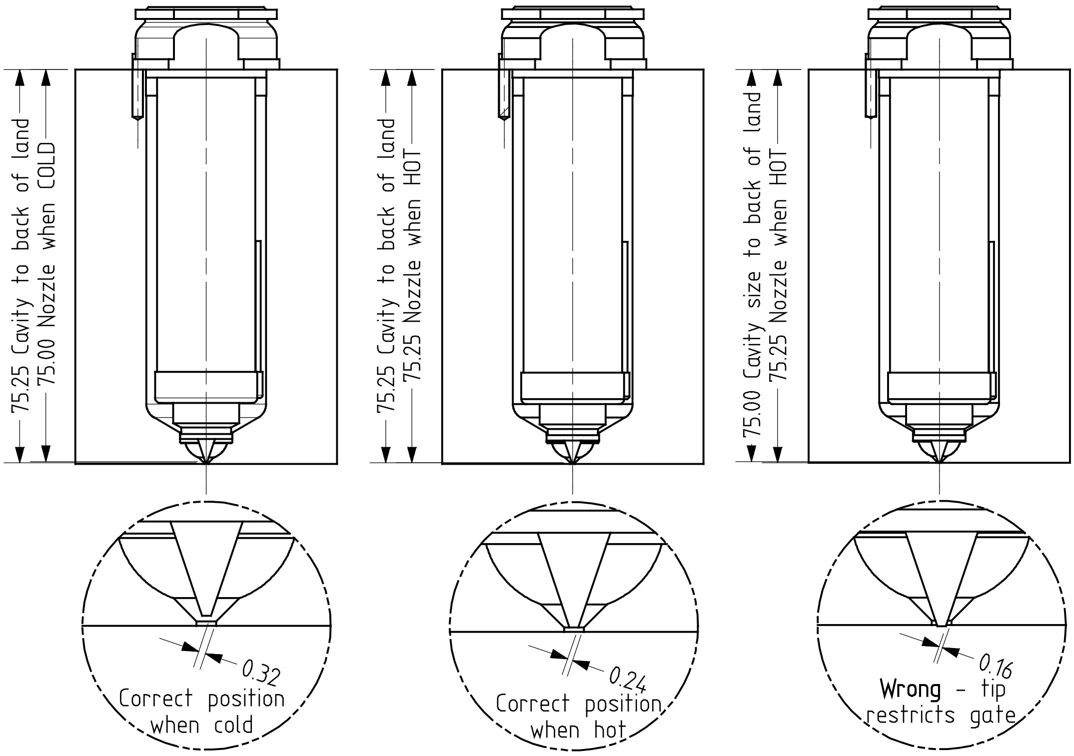


Figure 93: Correct Nozzle Tip Position When Cold or Hot (Torpedo Tip)

- Nozzle too small
- Mould too cold
- Exit from machine nozzle too small
- Nozzle blocked

Remedy: Check that the nozzle cavity is machined according to the dimensions for that nozzle. If the nozzle is too far forward, the front of the nut will touch the cavity plate in the gate area, which will allows greater heat loss through the nut contact.

If the cavity dimensions are correct for the nozzle, increase nozzle, mould and manifold temperature. Increase injection pressure. Enlarge the gate. Fit larger nozzle. Enlarge hole in machine nozzle. Clear blockage.

Nozzle drooling or stringing

Cause:

- Insufficient suck back
- Melt temperature too high
- Gate too big
- Insufficient gate cooling
- Incorrect nozzle type selected
- Nozzle too far forward in the cavity and the tip is pushed too far into the gate area (see Figure 93)
- Front of the nut is touching the cavity plate in the gate area

Remedy: Increase suck back. Lower nozzle and/or mould temperature. Check that the nozzle cavity dimensions are correct. Reduce gate diameter. Increase gate cooling. Contact Mastip for correct nozzle selection.

Gate not working

Cause:

- Heater failure
- Thermocouple failure
- Nozzle blockage
- Incorrect allowance for nozzle expansion
- Front of the nut is touching the cavity plate in the gate area

Remedy: Check/replace heater. Check/replace thermocouple. Remove and clean nozzle. Re-machine nozzle cavity.

Nut cracked

Cause: Nozzle too far forward in the cavity and touches the cavity plate in the gate area.

Remedy: Check the nozzle cavity dimensions to make sure they are correct.

Poor colour change

Cause:

- Incorrect colour change procedure
- Wrong type of nozzle

Remedy: See the Recommended Colour Change Procedure section for correct procedure. Contact Mastip for correct nozzle selection.

Excessive flash on the part

Cause:

- Too high an injection pressure
- Temperature too high
- Poor shut off face flatness
- Insufficient clamp pressure on moulding machine
- Tool plates flexing

Remedy: Reduce injection or pack. Lower nozzle, manifold or mould temperature. Increase machine clamp force. Change tool.

Burn marks or streaks on the part or near the gate

Cause:

- Not enough venting in tool
- Injection speed too high
- Gate profile incorrect
- Material not dry.

Remedy: Add more venting. Lower injection speed. Increase space and angle between the gate and the mould. Dry material.

Excessive tip wear in nozzles when using plastics with high glass fill content

Cause: Tip material too soft for application.

Remedy: Change to Grade 5 tips.

Gate vestige is too large

Cause:

- Gate too large
- Incorrect nozzle selection
- Gate profile machined incorrectly.

Remedy: Fit bush/sprue nut to reduce gate. Contact Mastip for correct nozzle selection. Check gate machining profile

Gate is freezing off too soon or during cycle

Cause:

- Melt too cold
- Gate too small for material being used
- Excessive cooling around gate
- Too much contact between nozzle and mould
- Gate profile incorrect or incorrect type

Remedy: Raise mould temperature around gate. Check machining of nozzle cavity and make sure contact is at a minimum. Check machining of gate profile and change if needed.

Flow lines on a large flat part

Cause: Incorrect nozzle type.

Remedy: Use a single-hole torpedo tip or open tip.

Bloom on the part is on opposite gate

Cause:

- Mould too cold
- Melt too cold
- Cold slug in part

Remedy: Raise mould temperature. Raise melt temperature. Use open tip.

Cold slug in the part

Cause:

- Wrong nozzle selection
- Head of nozzle too cold

Remedy: Contact Mastip for correct nozzle selection. Machine cold slug trap opposite gate. Ensure contact area on nozzle head is minimum.

Intermittent blockage caused by cold slug/tip fails by trying to extrude through nut

Cause: Too much heat loss through nozzle head.

Remedy: Reduce head contact to a minimum. Sit head in thermally insulated material.

Plastic sticking to the front of bush nut or sprue nut

Cause: Not enough contact between nut and mould to dissipate heat.

Remedy: Use bush nut or sprue nut with increased contact area to dissipate heat from nut.

Premature Wear on a Torpedo Tip (Multi-hole or Single-hole)

Cause: Tip is too far forward in the nozzle cavity resulting in higher friction in the gate area.

Remedy: Check the nozzle cavity dimensions and correct them so they match Nozzle catalogue or approval drawing.

Troubleshooting Valve Gate Systems

Cylinders do not work

Cause:

- No air
- Oil flow to cylinder
- Cylinder seized
- Not enough pressure in system

Remedy: Check lines, fitting pipes, and pump for leaks and blockages. Inspect cylinders for too many bends in feed pipes, restrictive fittings or valves.

Cylinders seized

Cause:

- Alignment of cylinder, manifold and nozzle incorrect
- Too much heat in back plate

Remedy: Check alignments. Supply more cooling around cylinder.

Cylinders jam when hot

Cause:

- Alignment of cylinder, manifold and nozzle incorrect
- Too much heat in back plate
- Spacers rubbing on shut off pin retainer

Remedy: Check alignments. Supply more cooling around cylinder. Re-align spacers.

Melt leaks from around shut off valve pin seal

Cause: Valve pin seal too loose in manifold.

Remedy: Check diameters of bush and manifold hole. Check height of seal and manifold hole.

Melt leaks from between the seal and the pin

Cause:

- Wear
- MFI of melt too high
- Pressure too high

Remedy: Check alignments of system. Replace pin and seal as a unit. Check melt MFI. Reduce fill pressure.

Melt sticks to the front of pin

Cause: Too much heat in pin.

Remedy: Reduce nozzle and gate temperature. Increase cooling time.

Pin does not shut off or bush nut is damaged

Cause: Nozzle operating at temperature different to one used to calculate nozzle expansion (E).

Remedy: Adjust pin position with pin retainer and half nut.

Troubleshooting Manifolds

Manifold will not come up to temperature

Cause:

- Thermocouple is loose
- Thermocouple is faulty
- Heater is shorted
- Heater wiring is loose or shorted

Remedy: Check thermocouple is tight and functions correctly. Check heater circuit.

Manifold is slow to heat up

Cause:

- One heater shorted or wiring is loose
- Insufficient manifold air gap
- Too much cooling above spacers
- Thermocouple is loose

Remedy: Check both heaters. Increase air gap to 10 mm minimum or use insulation board. Add insulation board to back plate or reduce coolant flow to back plate. Check the thermocouple.

Manifold temperature is not stable

Cause: Thermocouple is loose.

Remedy: Check thermocouple.

Metal contamination in the melt

Cause:

- Debris from plastic material
- Damaged machine screw

Remedy: Check purge for metal particle and repair machine screw. Check plastic for contamination.

Manifold leaks from the nozzle faces

Cause:

- Incorrect allowance for temperature expansion

- Machining of manifold heights inconsistent
- Back plate material too soft
- Manifold run at very high temperature for short time
- O-ring installation faulty

Remedy: Recheck calculations and correct (see Installing the Manifold section). Check and correct the heights. Change back plate. Check for damage and replace damaged or crushed parts. Replace any O-rings.

Manifold leaks from the deviation plug

Cause: No spacer fitted.

Remedy: Fit spacer.

Increased operating pressure

Cause: The nozzle is too far forward in the nozzle cavity.

Remedy: Correct the nozzle cavity so that the dimensions match the approval drawing or drawings in the Nozzle catalogue.

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